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Centrifugal Pump Fire Boats.*

BY CHARLES C. WEST, ESQ., MEMBER.

The modern fire-boat has become a necessary adjunct to the fire departments of sea, lake or river cities, and is viewed by underwriters as an important factor in determining insurance rates.

Not only is the fire boat a necessity for the extinguishing of fires along a water front, or protecting shipping, but it is now rapidly coming into use as an auxiliary water supply to the municipal pumping plants in cases of large or dangerous conflagrations. The pressure maintained and the volume supplied by the ordinary water supply system of the average city is insufficient in extreme cases, and most of the large cities are now installing the system of water mains drawing their supply directly from the water front.

To illustrate the value of the modern fire-boat and to demonstrate that the tendency is toward larger and more powerful boats, Plate 1 shows the street plan of one of our medium-sized marine cities with the auxiliary mains indicated thereon. Suitable connections are provided where these mains lead to the river. The absolute feasibility and practicability of this high-pressure main system has been demonstrated, and when these mains finally extend some distance inland, as they some day will, there will be higher pressure and more capacity required of the pumps on the fire-boat.

The city of New York has lately opened some high-pressure pumping stations on different points in the water front for fire protection, con-

sisting of multiple stage centrifugal pumps operated by electric motors. A good fire-boat with its shore connections accomplishes, of course, the same purpose. The commercial advantage which almost causes a business congestion near a water front demands ample protection, and therefore the size and capacity of fire-boats have grown with the cities.

Owing to the comparatively temporary nature of American building construction, the fire-boat has developed in the United States more rapidly than in foreign countries, and today the boats of largest capacity are to be found over here.

In the design of a fire-boat local conditions are of course of importance in determining such considerations as speed, ice-breaking and maneuvering qualities, etc., but in view of the fact that a fire-boat is merely a self-propelled pumping plant, interest centers in the pumps and the many fittings not common to other craft. For years there has been little difference in the great number of fire-boats built in all parts of the country. In most cases identical pumping machinery was used, differing only in the number of units installed. These units consisted of double-cylinder, vertical, inverted reciprocating pumps, each unit having rated a capacity of about 3,000 gallons per minute. Plates 2 and 3 show typical boats equipped with these pumps.

In order to get a smooth nozzle stream and sufficient pressure and have the pumps contained in the limited space offered by an ordinary hull, it was necessary to run these pumps at an exceedingly high speed. As a consequence, however, the strains on the machine were enormous, in addition to

which was the ever-present danger of valve trouble. The reciprocating pump, however, has served its purpose creditably, but the demand which has come for higher pressures makes its future adoption questionable.

Development of the Centrifugal Pump.

The development of the centrifugal pump of the multiple stage variety is comparatively recent, and the advent of the steam turbine has aided in its adoption, owing to the high speed attainable. In the boats equipped with turbines and two-stage centrifugal pumps in use at the present time, there has been no difficulty in obtaining higher pressures than are possible in the reciprocating pump. This pressure can be easily increased by increasing the number of stages with no effect on the structure or working of the pump.

Plates 4 and 5 show designs of centrifugal pump boats, the latter being one designed by W. I. Babcock for the city of Chicago.

The type of turbine used so far in operating these centrifugal pumps has been the horizontal impulse type. While this type of turbine possesses the advantage of being more compact than the reaction turbine, it is also claimed by turbine builders that it can be started without being warmed up, a performance said to be dangerous in the reaction turbine owing to the liability of warping the spindle.

In the operation of fire-boats of late years the latest practice has been to use hose lines less and discharge the streams either directly from the boat from stationary nozzles, or, as before mentioned, into underground water mains. With the powerful streams now at the command of the firemen, it is of course necessary that the huge noz-

*Paper read before Society of Naval Architects and Marine Engineers, New York, Nov. 20, 1908, by Mr. W. I. Babcock in the absence of Mr. West.

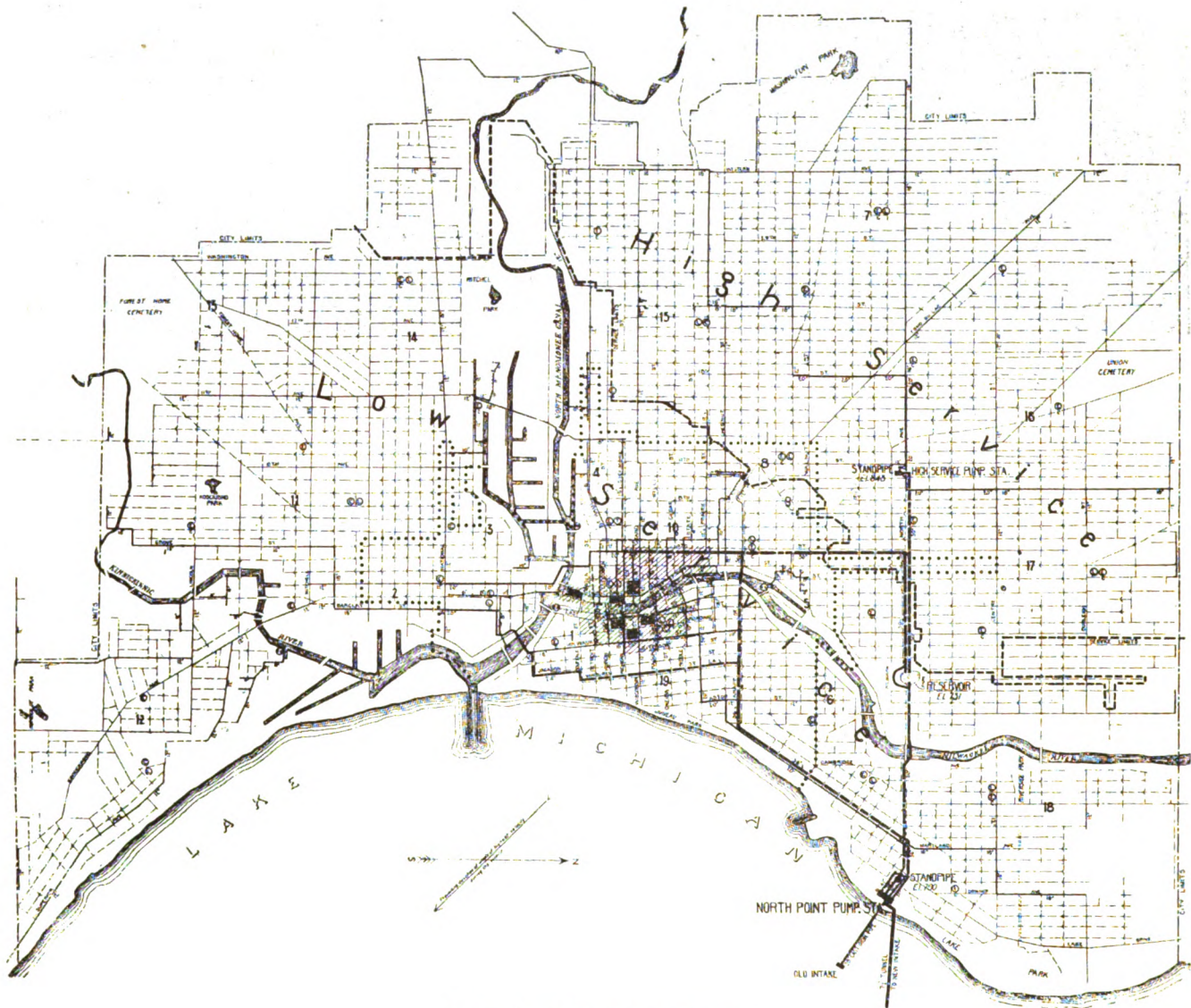


PLATE I.—MAP OF MILWAUKEE.

zles used be not only fixed to the boat, but also mechanically operated. This is done either by affixing them to towers, tops of deck-house, or platforms, as shown in the various drawings. Hose connections are made either with the bulb turrets illustrated herein, or quick-opening valves on the sides of the deck houses.

Inasmuch as the interest in a fire-boat centers in her pumps, and as the turbine centrifugal pump and outfit represents the latest practice in this line, the writer gives the result of a test made on the first of the two 9,000-gallon boats designed by Mr. W. I. Babcock, for the city of Chicago and just delivered to them.

Inasmuch as these were the first centrifugal pump boats to be used on the great lakes, the results of their tests were watched with much interest.

The general dimensions of these boats, the Joseph Medill and the Græme Stewart, are:

Length over all, 120 ft.
Length of keel, 109 ft. 6 in.
Beam, 28 ft. 0 in.
Depth, 15 ft. 0 in.
Displacement, 500 tons.
Draught, 9 ft. 6 in. mean.

In the plans as illustrated in Plate 5 it will be noted that a unique propulsive scheme was used. The main pumping and power machinery consisted of two 660-H P. Curtis turbines direct connected to 200 K. W. direct-current generators and two stage centrifugal pumps. The generators served to provide current for the propelling motors which are of the variable speed-reversing type. In going to a fire the pump impellers run dry. Control of these motors is possible by rheostats in both the pilot house and engine room, and in the test the captain easily handled his boat without the aid of the engineer.

There are two pumping-generating sets in each boat, and twin screws. Steam was supplied by two-furnace

Scotch boilers, 11 ft. 6 in. long by 12 ft. 6 in. diameter; 1,910 sq. ft. heating surface in each boiler and 42 sq. ft. of grate surface. Forced draft is provided on the closed stoke-hole system.

In Chicago river where these boats are to be used most of the old center pier bridges have been removed and it is necessary at times for a fire-boat to maintain itself in the middle of the river. On this account mooring spuds were adopted, operated by steam, raising and lowering gear.

As shown in the drawings the principal water outlets consist of two monitor nozzles placed on a platform directly above turrets on which are the hose connections. The pumps, though usually run singly, can be compounded, and a nozzle pressure of over 300 pounds was thus obtained on the test with a resultant capacity of about 5,000 gallons per minute.

In connection with this boat, the results of an eight-hour endurance

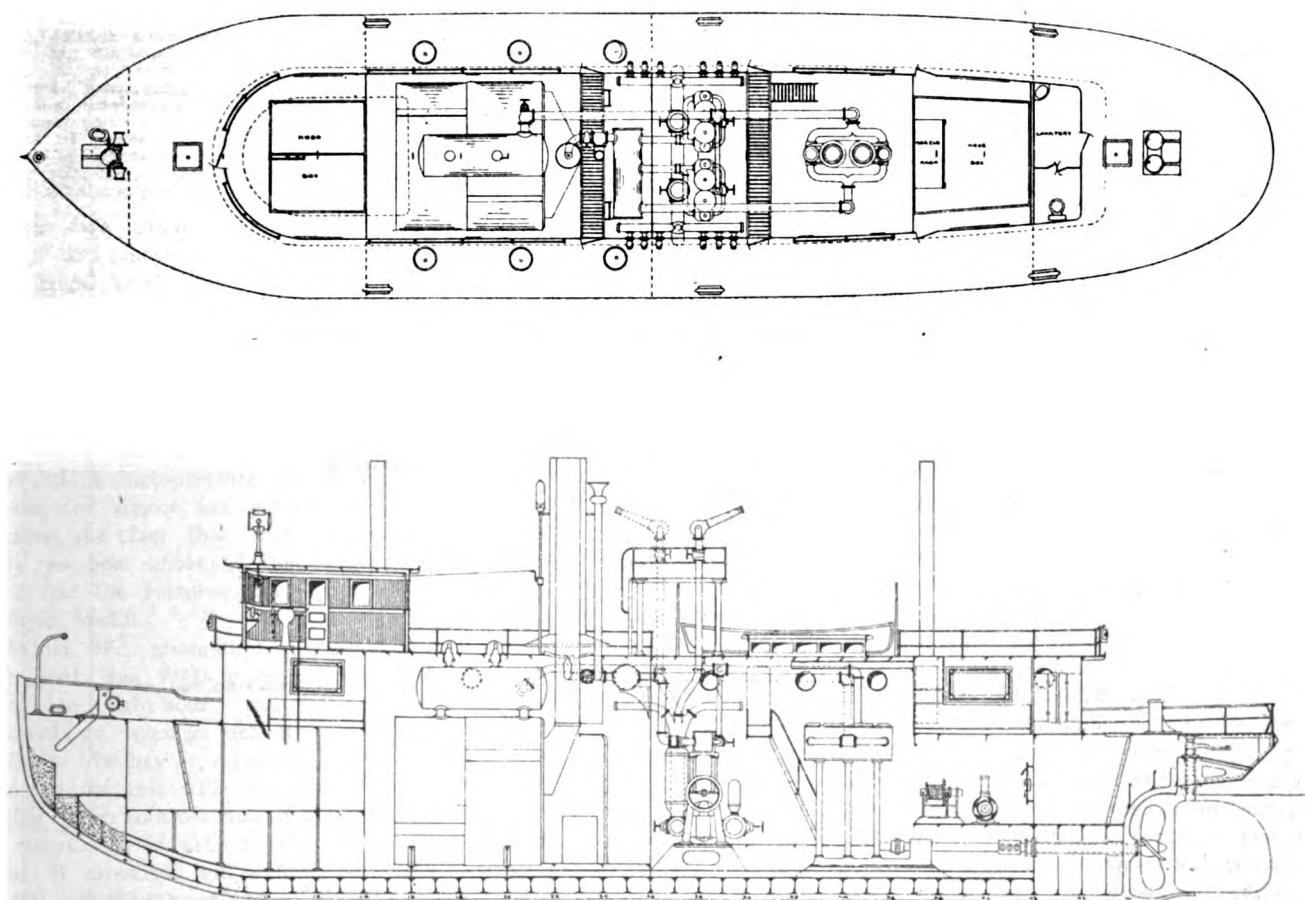


PLATE 2.—DESIGN FOR A TWO PUMP BOAT, PISTON PUMPS.

test may be of interest. Owing to the late date at which the test was held, it is impossible to work up the test in more detail, but the data given show the average performance of the machinery during this run.

Notes on Eight-Hour Endurance Test.

Coal consumption was measured by leveling bunkers before and after test, and estimating the weight from the cubical contents, the weight per cubic foot being determined from samples.

Feed water was run through a hot water meter and measured, and the meter afterwards calibrated. The make-up feed which measured the steam consumption of the auxiliaries was also metered, and this reading, deducted from the total water used, gave the steam consumption of the main turbines.

Pressures at the nozzle were measured by a Pitot tube held in the stream, and the discharge computed from the equation:

$$Q = 29.9 D^2 \sqrt{P}.$$

Where

Q = Discharge in U. S. gallons per minute.
 D = Diameter of nozzle in inches.
 P = Pressure reading of Pitot tube in pounds.

The summary of the test follows:—

Date Oct. 28, 1908.
 Duration of run 8 hours.
 Barometer 29.53"

TEMPERATURES.

	Degrees.
External air	50
Engine room	54.8
Circulating water, final	75
Circulating water, initial	51
Circulating water, range	25
Dry vacuum pump discharge	131.3
Feed water, final	164.0
Feed water, initial	106.4
Range	57.6

REVOLUTIONS.

Turbine, starboard	1,660
Turbine, port	1,634
Circulating pump	285
Dry vacuum pump	123
Blower engine	537
Strokes per minute (single strokes):	
Hot-well pump	133.6
Feed pump	95.2

PRESSURES.

Boiler pressure,* starboard	156.8 lbs.
Boiler pressure, port	156.5 lbs.
Main steam at turbines, starboard	156.5 lbs.
Main steam at turbines, port	154.0 lbs.
Condenser vacuum gauge	27.3"
Draft gauge in fire room	0.83"
Centrifugal fire pumps, starboard	157.5
Pressures, port	157.0
Mean	157.25 lbs.
Nozzle pressure, starboard	101.3
Nozzle pressure, port	101.0
Mean	101.15 lbs.
Number of nozzles	2
Diameter of nozzles	4"
Gallons water discharged per nozzle per minute	4,808
Gallons, total boiler discharge per minute	9,616
Gallons, total boiler discharge per hour	576,960
Water horsepower of pumps, each	442.5
Water horsepower of pumps, total	885.0
Coal burned, total lbs.	26,500
Coal burned, per hour, lbs.	3,310
Coal burned, per square foot G. S. per hour, lbs.	39.4
Feed water, per hour, lbs.	23,750
Make-up water, per hour	2,205
Steam consumption—	
Steam turbines, lbs.	21,544

*Boiler gauges are placed in engine room over switchboard. This would probably account for the small drop in pressure between boiler and turbines.

Since this trial was made and the foregoing results worked up and forwarded to the secretary, it was discovered that the impellers of the pumps had been fitted too closely and were rubbing badly and it has been found necessary to take them out and give them more clearance. The figures given in the printed paper, therefore, for the B. H. P. of the turbines are quite unreliable and the actual B. H. P. was undoubtedly considerably more than the amount stated. How much more it is impossible to say, as there is no way, of course, to determine what was the increased resistance in the pumps caused by this excessive friction of the impellers. It may be stated, however, that all four sets for two boats—turbines, generators and pumps—were thoroughly and carefully tested at the works of the General Electric Co. at Schenectady before shipment to Manitowoc, and that the water consumption per B. H. P. worked out at 15.8 pounds, and the efficiencies of the pumps varied from 70 to 75 per cent. This was with a steam pressure of 160 lbs., vacuum 30 in., and developed B. H. P. 675, and the steam was dry. In the Manitowoc test the steam pressure and vacuum were slightly lower and the moisture in the steam, determined by calorimeters close to the

turbine throttles, was 2.3 per cent. Assuming that the steam consumption of the turbines went up to $16\frac{1}{4}$ lbs., which seems a fair allowance, the B. H. P. would have been about 1,325, the efficiency of the pumps about 67 per cent, the B. H. P. per square foot of grate about 15.8, and the coal per B. H. P., with no deduction for the auxiliaries, about 2.50 lbs., corresponding to about 2.25 lbs. per I. H. P. All these figures, it must be remembered also, are the averages of 15-minute readings extending over eight full hours, including all the necessary cleaning of fires, and with the same fire room crew for the whole time.

Since then more clearance has been given the impellers and during the present week the pumps have been put through the required four-hour test, running absolutely dry, without the slightest trouble of any kind, and a subsequent examination of the impellers showed no sign of rubbing whatever.

Data of the Trial Trip.

Because of the unusual character of propelling machinery some items in connection with the trial trip performance may be of interest. The boat was run over a course from the Manitowoc breakwater to a point opposite the breakwater at Two Rivers, Wisconsin. The two breakwaters are very nearly parallel and the course as measured from the government charts is five and one-half miles. The time of start and finish was taken, and readings of R. P. M. and switchboard were taken at five intervals. The results follow:

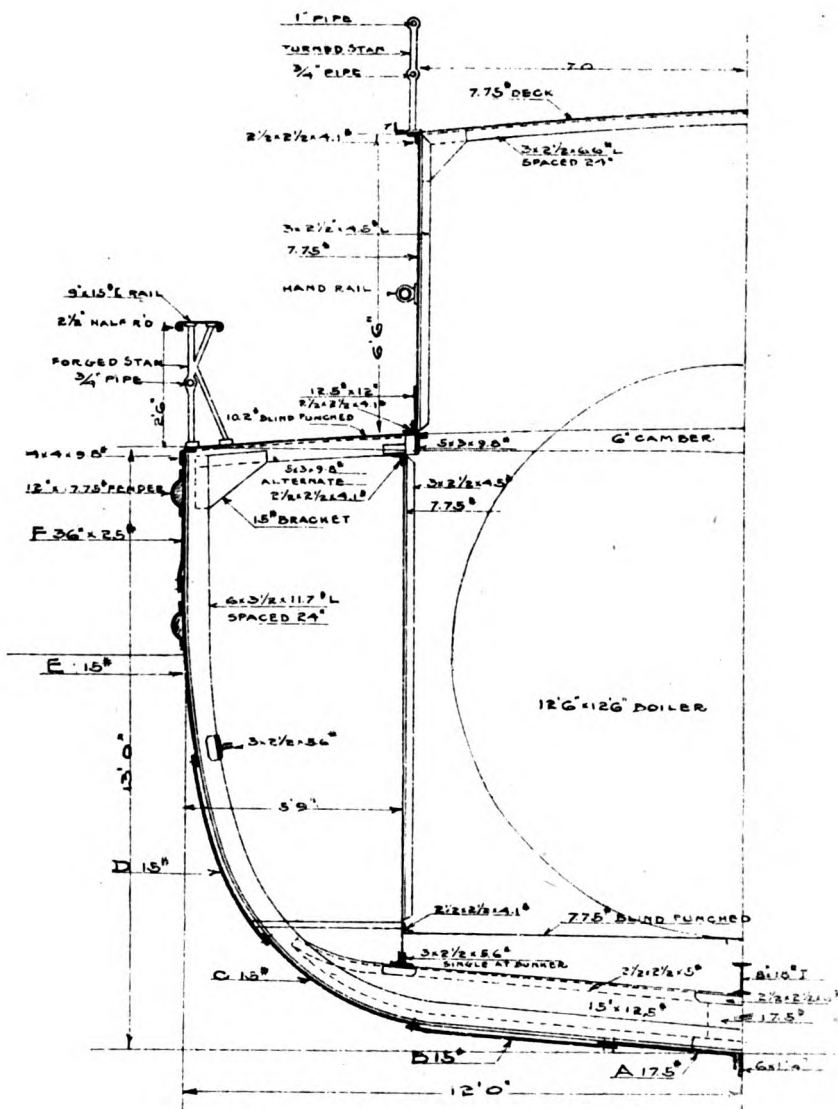


PLATE 2.—MIDSHIP SECTION OF TWO PUMP BOAT.

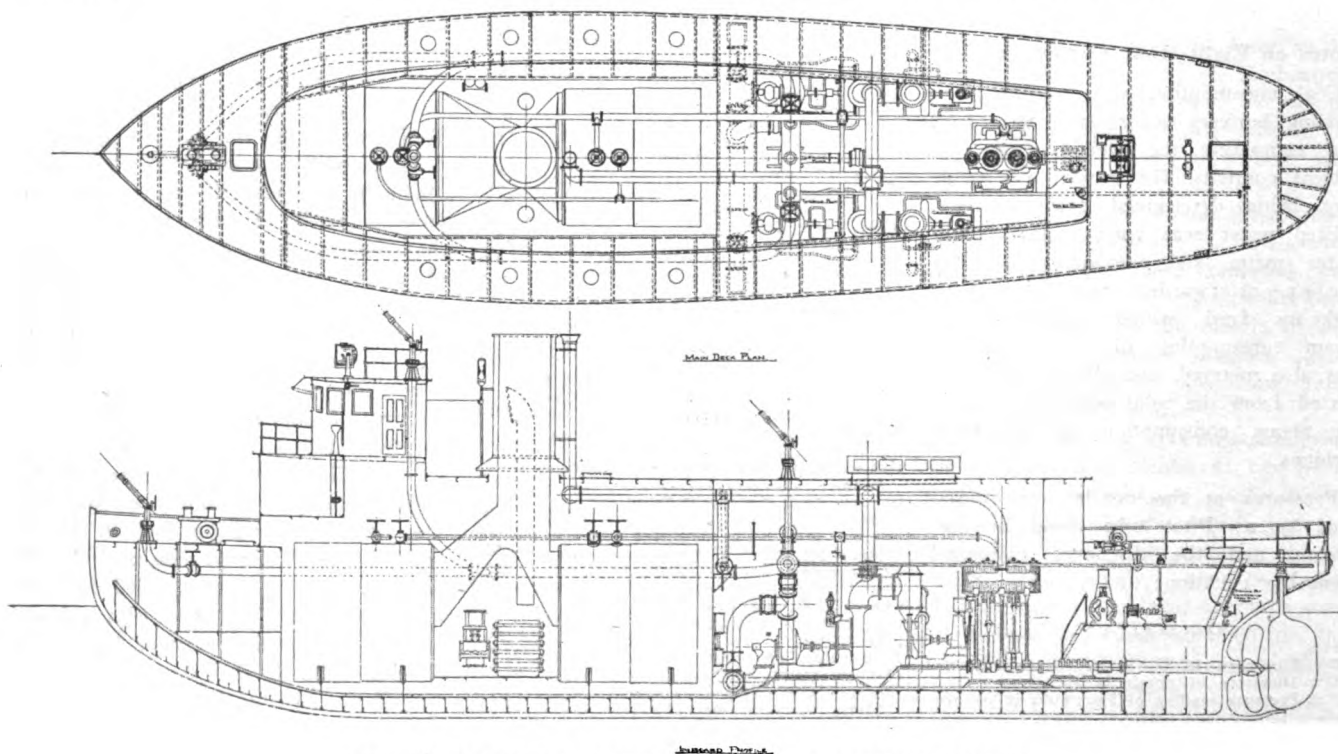


PLATE 3.—DESIGN FOR A TWO PUMP BOAT, CENTRIFUGAL PUMPS.

Date	Oct. 30, 1908.
Distance	5½ miles
Time mean of two hours.....	28.25 min.
Speed (statute miles per hour).....	11.7
R. P. M., starboard motor.....	179
R. P. M., port motor.....	178
Developed horsepower:—	
Motors, starboard	203
Motors, port	166
Output of generators, starboard.....	223
Output of generators, port.....	181
Motor efficiency, starboard, per cent.....	91.0
Motor efficiency, port, per cent.....	91.8

The data obtained from the foregoing test shows not only that the centrifugal pump is a more powerful and reliable machine than the old type, but also that the greater economy of the turbine outfit makes it possible to do more work with about half the boiler capacity. Comparing the water rate of these turbines with that of a high-pressure pump taking steam for almost full strokes demonstrates the fact that there is probably no boat afloat of the same size that has the pumping capacity of the Joseph Medill.

While the guaranteed capacity of the boat was 9,000 gallons per minute, the eight-hour endurance test showed an average delivery of 9,600 gallons. As may be surmised, the builders ran the test with the idea of fulfilling their contract and not to make a record. It is safe to say that this boat, if crowded, will deliver between 10,000 and 11,000 gallons of water per minute at 150 pounds pressure.

Discussion.

Mr. J. G. Winship: In this paper by Mr. West describing the Chicago fire-boats, designed by Mr. W. I. Bab-

cock, I wish to compliment Mr. Babcock on his original method of combining a centrifugal pump and electric generator to a steam turbine and driving the boat with motors.

But to New York belongs the credit of being the first to use the centrifugal pump on fire-boats and to Fire Commissioner Hays is due the credit of having the courage of breaking up the habit of the New York Fire Department in waiting until the improvement has been tried in the West before taking it up here.

Upon the earnest solicitation and guarantee of the Henry R. Worthington Co., it was agreed to try the centrifugal pumps on the two projected fire-boats with the rigid specification that in case the pump failed to perform the work guaranteed on the first or second trial, the contractor was to remove them and should install in their place, reciprocating pumps similar in design to those on the "Abram S. Hewitt," and to be of the same number and size, which would cost more than the pumps specified. The engines, pumps and boilers were laid down and then the boat was laid out around the machinery. The designers, Messrs. Millard & MacLane, did their work nobly, producing a boat that went away ahead of the specifications. The boats are 123 ft. long, 27 ft. wide and 14 ft. 9 in. deep. On trial the boats made a speed over the measured mile at Riverdale of four (4) minutes

and twelve (12) seconds, going up against the tide, and three (3) minutes and thirty-five (35) seconds going down, equal to 15.38 miles per hour.

The main engine is a fore and aft compound with cylinder, 18 x 38 x 26 inches. Steam supplied by two Babcock & Wilcox boilers each having 2,250 sq. ft. heating surface with 63 ft. grate surface. Air tight fire room with a blower discharging 20,000 cu. ft. per minute, steam pressure 200 lbs. One surface condenser having 2,700 ft. of surface in which the main engine, turbine engines and electric light engines exhaust. The air pump is a Blake vertical twin beam with cylinders 9 x 18 x 12 inches. The feed water heater has 180 ft. The fire pumps are arranged in two units in each boat, each unit to deliver 5,500 G. P. M. against 125 lbs. pressure, or 4,500 G. P. M. against 150 lbs. pressure, when operating at 1,800 revolutions per minute, when the turbines are supplied with 10,000 lbs. of dry steam per hour, and 26-inch vacuum. The fire pumps are driven by General Electric turbines of 600 horsepower each. To show how liberally the boats were furnished with power, one of the boats on trial ran from West Twenty-third street to the Battery, with the engine making 160 revolutions per minute, both pumps running carrying 150 lbs. pressure, the boilers maintaining 200 lbs.

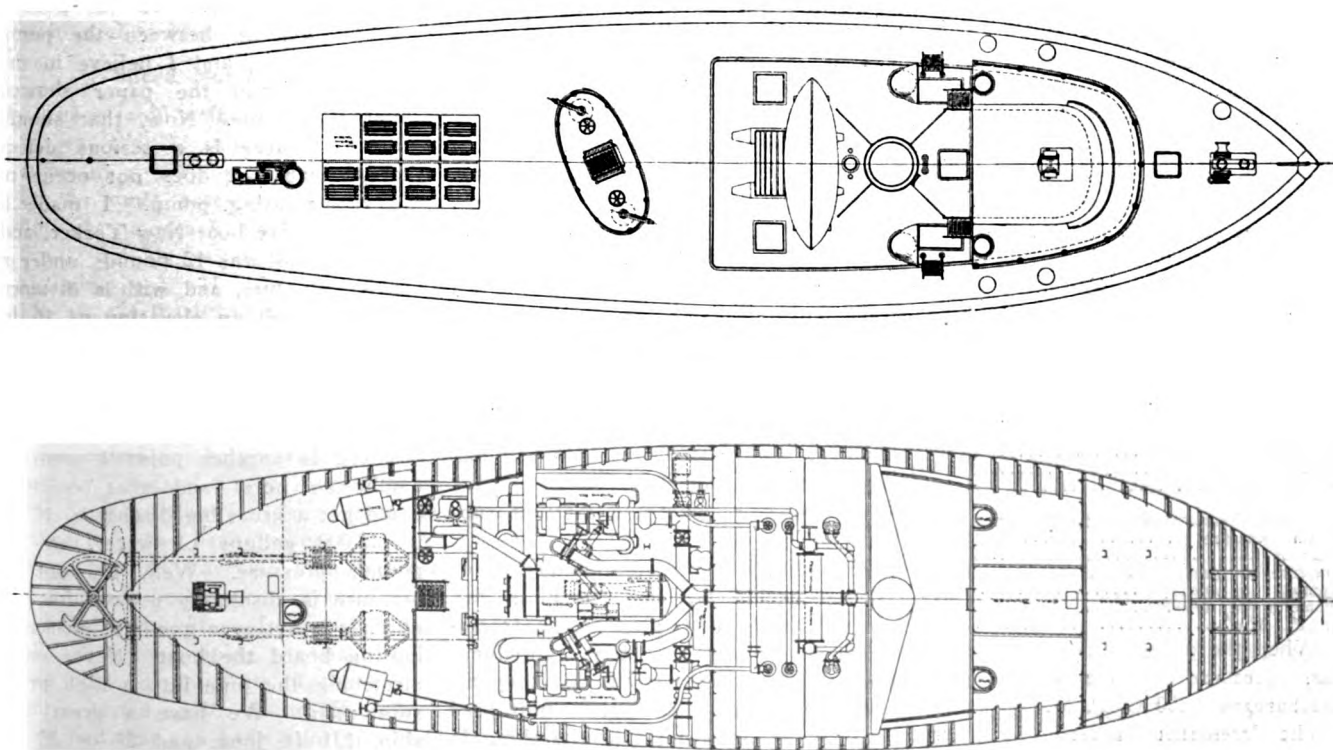


PLATE 4.—PLAN VIEWS OF THE ELECTRICALLY PROPELLED CENTRIFUGAL PUMP BOATS REFERRED TO IN THIS PAPER.

To illustrate paper on "Fire Boats," by Charles C. West, Esq., Member.

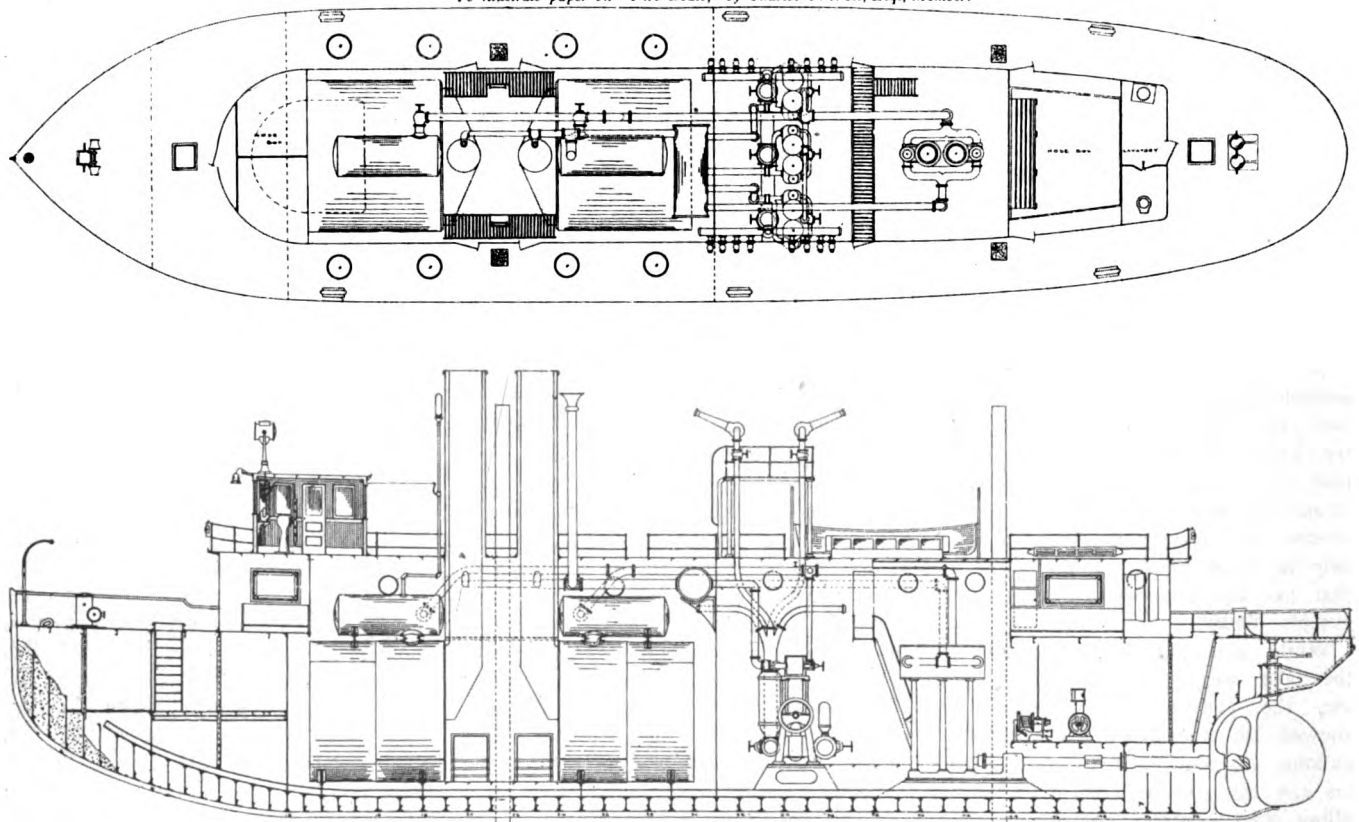


PLATE 5.—DESIGN FOR A THREE PUMP BOAT, PISTON PUMPS.

pressure, with 27 inches of vacuum all the way down.

The good workmanship done by the contractors, Messrs. Alex. Miller & Bro., was shown by the fact that from the time steam was first generated until the boats were turned over to the city, not a flange or bolt leaked, and all parts of the machinery worked perfectly, showing careful calculation of Messrs. Millard & Mac-lane. The city now owns two of the best fire fighters in the world. The following figures show the performance of the pumps on the trial trip, each boat, the "Thomas Willett" and "Jesse Duane," performed so near alike the following figures will do for both:

TEST OF FIRE PUMPS MADE MAY 26, 1908.

WATER DISCHARGED, 9,000 G. P. M.
 Steam pressure 200 lbs.
 Vacuum 27 inches
 Pressure at pump 160 lbs.
 Number of nozzles 3
 Diameter of nozzles 3 inches
 R. P. M. 1,800

WATER DISCHARGED AT 9,625 G. P. M.
 Steam pressure 200 lbs.
 Vacuum 27 inches
 Pressure at pump 175 lbs.
 Number of nozzles 3
 Diameter of nozzles 3 inches
 R. P. M. 1,800

When the pump works in series 300 lbs. pressure is maintained easily discharging 4,500 G. P. M.

The President: In view of the great importance of the fire boat service in the city of New York, Chief Cro-

ker of the fire department has kindly asked Capt. John Kenlon, acting deputy chief of battalion, of the main department, and superintendent of the marine fire service, to be present here this afternoon, and I am sure we will all be very much obliged if he will express his views on the condition of the fire boats, and give us his ideas of what he thinks they ought to be.

Remarks of Mr. Kenlon.

Mr. Kenlon: I am at a loss to know how to address this meeting. I presume, by the title of this paper, it is the Society of Naval Architects and Marine Engineers. I received a copy of this paper through the mail this morning, and I have not yet had time to read it; but when Chief Croker called me up on the phone and told me I was expected here at two o'clock, I asked him what the subject was, and he told me it was fire boats. So, of course, I am always ready to say something on that subject.

In recent years the tendency of naval architects, in designing fire boats, has been to go from the reciprocating pump to the centrifugal pump, and after a trial trip they all come up here and have a bottle of wine, and make out that the thing is all right. Of course, we take hold of this end, and we see afterwards

where the defects are. We have had tests on fire boats, of course, and there is one thing I saw happen in a Chicago boat, and also in the New York boats, and that is the extraordinary loss of pressure between the pump and the nozzle. You will see, in New York there was 60 pounds loss of pressure between the pump and the nozzle, and I believe in the test in Chicago the paper showed about 57 pounds. Now, that should not be. There is a serious defect there, because it does not occur in the reciprocating pump. I made a test on the fire boat New Yorker, and the only loss was 12 pounds under a heavier pressure, and with a distance of 80 ft., with an elevation of 16 ft. from the pump to the nozzle. Now, let's speak of something that you gentlemen ought to work out. I do not know how to work it out.

There is another point I wish to emphasize here, and that is they could get a great big discharge, 11,000 to 12,000 gallons of water, at 125 pounds pressure. Well, 125 pounds pressure is absolutely useless for fire duty. It is not even good for discharging on board the boat. Never mind stretching the pipe into a high pressure main. We have a great big ship, 131 ft. long, and 27 or 28 ft. beam, and all that, and when we want to pump into a high pressure main we

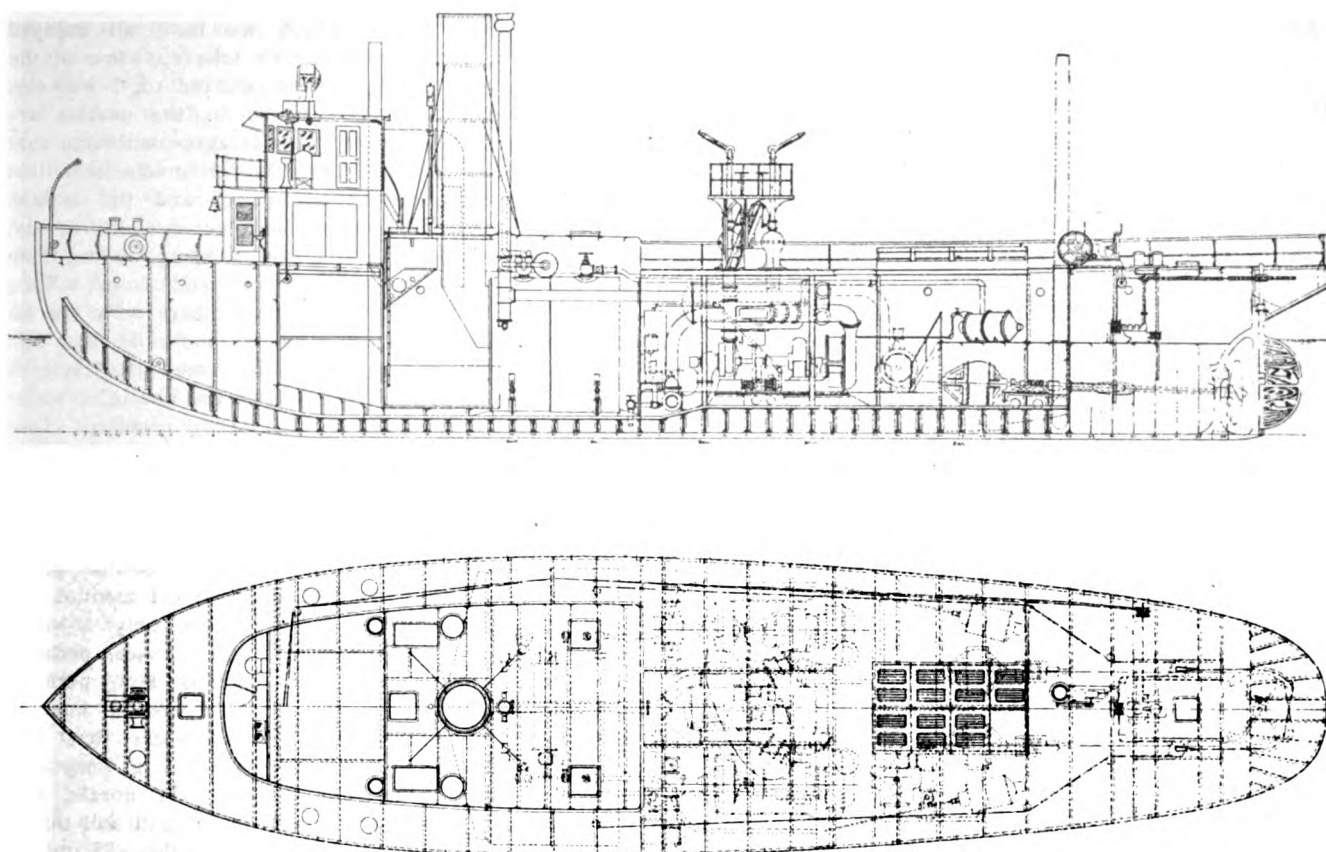


PLATE 6.—SECTION AND PLAN OF THE ELECTRICALLY PROPELLED CENTRIFUGAL PUMP BOATS REFERRED TO IN THIS PAPER.

get 4,000 gallons of water. The fire boat New Yorker will deliver under the same conditions 9,000 gallons of water. Just as soon as you get 150 pounds pressure, your boat is cut in half; and you want to get over 150 pounds pressure at all fires, and for all practical purposes, so you must add another stage to your pump.

Speed Not Sufficient.

There is just another thing I want to say, that 11 miles an hour is not sufficient speed for a fire boat. One of the most essential things in fire duty is to reach the scene of the fire as quickly as possible, and a boat steaming only 11 miles an hour is like an old truck going to a fire.

Now, these few random remarks are from my own experience. Of course, I have not had time to digest the paper and have not read it, and only looked at the pressure. I might say, in passing, that I do not favor the Scotch boiler for a fire boat, because it is too heavy when you come to get steam. Carrying high pressure, the lighter boiler gives a chance for a lighter draught, and when you take all the heavy piping we put into a fire boat to stand all of these pressures, tested up to 400 or 450 pounds, you find that you have a lot of weight in there, and must have beam to carry

it, and of course you lose speed. If there is anyone who would like to ask me any questions, I will try to answer them. I have had lots of practical experience, but I have not had time to digest this paper.

The President: What do you consider the limit of draught proper for a fire boat in New York city, and how does that affect the efficiency of the service?

Mr. Kenlon: I consider the limit of draught 10 ft., because the fire boat operates near the shore all the time. Ninety-five per cent of our fires are along the shore, wharves, and places where there is not a great deal of water, and you cannot have a draught above 10 ft. in the boat and do any effective work. I might say in that connection that I consider 120 ft. the limit of length. If you get a boat too long, these boats are hard to work in the water, as they are narrowing the stream all the time, and there is a strong tide, and it is all a skillful pilot can do to get one of the large boats across the tide. You want a tug boat along with her to dock her, the same as though it were a trans-Atlantic liner. If I am jarring the nerves of some of these naval architects, you will have to excuse me. That is what I came here for.

Trouble With Suction.

Mr. F. L. DuBosque: The most serious trouble source, in fire boats, is the suction action. In the harbor there is a lot of ice and driftwood. I ask if you have from experience examined at what height the suction connection should be placed on a fire boat?

Mr. Kenlon: My idea is they should be placed at the turn of the bilge, far enough from the surface to avoid taking in drifting wood and far enough from the bottom so that you won't take up the mud. The standard should be at least two and a half times the area of the pipe.

Mr. J. G. Winship: How does the nozzle pressure and the pump pressure compare with the fire boat, with the high service pump you have in use?

Mr. Kenlon: They don't compare. The high pressure pumps deliver the water at the hydrant at a greater pressure. I tested that high pressure service, and we had 310 pounds at the Gansevoort street station, and 600 ft. away we had 300 pounds on the hydrant, and on the fire boat we lose 60 pounds inside of 20 ft. Of course, there is a great deal of that lost in the nozzle, I will admit, but it cannot be all lost there. We use copper piping.

The President: What pressure do you think the fire boat should have for its greatest efficiency?

Mr. Kenlon: I don't favor going much over 150 pounds nozzle pressure, because when you get over that the stream is turned, and the water whipped into a foam. It leaves the nozzle in such a way that it disintegrates very quickly and does not hold together, but you should have 150 pounds nozzle pressure.

The President: Are there any other questions to be asked, gentlemen?

Mr. W. L. R. Emmett: I ask how high you go in the speed, when you have an efficiency in pressure, which you might make up by increasing the speed? Do you keep any speed limit, or let it go pretty high when you want more pressure? The pressure in the pump goes up with the speed.

Mr. Kenlon: I don't know of any way of getting pressure except with speed, except you close the gage.

Mr. Emmett: What is the limit?

Mr. Kenlon: We have run as high as 2,000 turns. Eighteen hundred turns was the contract, but we have run up to 2,000. You ought to get pressure in any pump by speeding it up. There is a factor to determine, what the loss is there as you increase the speed, and that is for you gentlemen to work out.

Mr. W. M. Day: I ask if the nozzle connection on the reciprocating pump, which only lost 12 pounds pressure, had as crooked connections as the one with the centrifugal pump.

Mr. Kenlon: Same style of nozzle.

Mr. Day: The high pressure had a drop of 12 pounds in one case and 60 pounds in the other?

Mr. Kenlon: Yes.

Mr. Day: In the case that Manitowoc, the nozzle connection was quite crooked, came around on each side into the trunnion, and turned out, which accounted for a good deal of loss, but it would seem as though all the drop in pressure should be due to some circumstances connected with the pipe, because after the water has left the pump the pump has no more influence over the water.

Mr. Kenlon: I have not been able to work out just what was the cause. Perhaps some of you gentlemen may be able to find out the cause. I know it is there. I do not think we should reach out for too great a volume of water, at too low a pressure. The practical pressure for fire duty is about 240 pounds. That is the practical pressure, the pressure we more often work at than anything else is 240 pounds.

You take and stretch a line of hose ashore 900 or 1,000 ft. of hose, and your 150 pounds pressure is useless and no good. You want 240 or 250, and then you can deliver a good stream, what we call a good working stream, but you cannot do it with 150 pounds.

Mr. Martin L. Katzenstein: I ask the chief whether he experienced any trouble in the New Yorker in supplying a stream with the three reciprocating fire pumps?

Mr. Kenlon: A great deal of trouble—we could not supply it. That is the reason we asked for something different. I am in the main responsible for the centrifugal pump, because when the New Yorker was running four sets of pumps her boilers would not supply the steam.

Mr. Katzenstein: The centrifugal pumps on the new boats correct that trouble?

Mr. Kenlon: Yes, they did, you can get all the steam you want for these boilers, run the pumps, and run the engines, too.

Mr. Winship: They went down from Fourteenth street to the Battery with 150 pounds pressure on each pump, and the engine making 150 revolutions, and 200 pounds of steam, and 27 inches of vacuum.

Mr. Kenlon: You deduct about 30 per cent off of that for practical work. You all know what these trial trips mean. You have given wine to the stokers. I do not know how they do in Chicago, but they are usually worse out there than they are here.

Mr. Winship: You cannot say that about the engineers, they never had a drop.

Mr. Kenlon: You were there.

The President: I think you want to thank Capt. Kenlon for coming here this afternoon, and for making the practical remarks on the subject of fire boats which he has made, and I believe we are under many obligations to him for his kindness. I hope he will express our pleasure to Chief Croker. If there is no further discussion, we will call on Mr. Babcock to close the discussion.

Mr. W. I. Babcock's Reply.

Mr. W. Irving Babcock: I will not attempt, of course, to answer the discussion as if I were the author of this paper. I presume when the discussion is printed finally in the Transactions, Mr. West will make his own answer, but I will make a few remarks myself.

The most practical criticism we have had, what, of course, is entirely practical and not theoretical criticism, has been from Captain Kenlon's re-

marks, which we have all enjoyed very much. To take up some of the points that he referred to, I will say, first, that as far as the nozzles are concerned I quite agree with him that there is entirely too much force lost between the pump and the nozzle. Why that is so I am not able to say, I am not a nozzle expert. I find from some observation, and from talking with firemen and others who are familiar with nozzles and build them and use them all the time, that there is something about a fire nozzle or water nozzle which is very peculiar. Two nozzles, in fact, you may say 100 nozzles may be built from exactly the same drawings and exactly same size and exactly same gages, and be turned out as nearly as possible exactly alike, by the practical men of experience with nozzles, only a small proportion of these nozzles, perhaps 10 per cent, perhaps less, perhaps a little more, will deliver a smooth, beautiful stream of water that will hold itself together for a long distance after it leaves the nozzle, and will throw more water and will throw it farther than the other 85 or 90 per cent of the nozzles will do. In the bad nozzles the water begins to spread and feather, you might call it, almost as soon as it leaves the nozzle, and this does not depend on the pressure behind it. I mean that it will have the same effect and act in the same way, whether the pressure is 100 pounds or 300 pounds. None of the persons who use the nozzle seem to know why that is so, but in all the nozzles I have observed so far there has been much jar between the pump and the nozzle, but which I do not think is right, but do not know how it can be helped.

High Speed Not Necessary.

In regard to the speed of the boats, the captain said that the New York boats made 15 miles an hour, and as the Chicago boat only made 11½ miles an hour, she was no good. As far as that point is concerned, I do not know that it is exactly in order to tell an assembly of naval architects what probably Captain Kenlon himself appreciated and that is the speed of the boats, as well as pretty nearly everything else about it, depends on the conditions it has to meet. A boat that makes 15 miles an hour would be of no use whatever to Chicago. The conditions there are very peculiar. The two boats that are in use in Chicago are intended to stay in the Chicago river. The Chicago river is a very narrow, very tortuous stream, and in

all times of the year, particularly in summer, it is choked with shipping of all kinds. I doubt if the river is at any place much over 300 ft. wide. In a great many places it goes down to 100 ft, and there are a great many bridges in which the opening is from 60 to 70 ft. wide. In that river are operated a great many ships that will run up to 400 and 500 ft. long, and up to anywhere from 50 to 60 ft. beam. The city of Chicago is built on either side of this river. There are two rivers really, because it branches at a short distance from the lake, and the business center of the city is washed on one side by the main river and the south branch, and necessarily, for the communication between the different parts of the city, there are a great many bridges. The fire boats operating there cannot pass under these bridges, and I do not see any use for having power enough to make 15 miles an hour, when we cannot run two blocks at any one time, without stopping for a bridge to open. For that reason, the propelling power was small, and the fact that the boat made 12 miles an hour was somewhat of a surprise to all of us. Probably 10 miles an hour would be just as good, as far as getting to a fire promptly was concerned.

Why Twin Screws Were Installed.

Besides the river itself, there are, particularly in the south branch, and also in the north branch, to some extent, a great many slips at right angles to the river, and some of them run up to 1,000 ft. long, with a width anywhere from 100 to 125 ft. A fire is apt to take place at the end or side of some of these slips, as it is in the river itself. The fire boats should, naturally, get as close to the fire as possible. In order, therefore, to make a boat that could be handled, could be maneuvered so that she could be placed where the boat would have the most effect on the fire, and still, in case of danger of a sudden spreading of the fire or falling of walls, or anything of that sort, could get out quickly, it was considered necessary that we should have twin screws. The decision had already been reached to use centrifugal pumps, driven by steam turbines. The controlling condition there was, what has been referred to more or less, that the reciprocating pumps operated at high pressure, with the draft turned into the stack, even under those conditions it is impossible to put boilers enough into the hull of the boat of a size that can be handled to keep the pumps operating at their full

power. Of the six or seven present fire boats in Chicago, I think that most of them are 9,000 gallon boats, so rated, and the other 6,000 gallon boats. They had there, either two or three sets of 3,000 gallon pumps. I think it is perfectly safe to say that not one of these boats could operate for any length of time, over an hour; I would almost put it less than that, and deliver much more than one half of its rated capacity. The boilers that you can get into the boat are not big enough and cannot make steam enough to keep the pumps running. We therefore decided before the pumps were started, to use the centrifugal pump and turbine and put in a surface condenser in order, of course, to get the benefit of the vacuum. Then it came to the question of the propulsive machinery. Desiring twin screws, if we had put in the two reciprocating ordinary steam engines, either single or compound, it meant that if they were operating at a fire and the boat had to be shifted into position, which would probably have to be done, constantly, that it would take two men to handle these engines under bells from the pilot house.

It seemed simpler, and I am satisfied that in the end it will be found much better, to put a generator between the turbine and the pump, to put motors on the twin screws on the shafts, and to arrange the pumps so that they could be run without water. With these boats, when they are lying at the station at the dock, waiting for an alarm, the usual steam pressure carried on a fire boat, under such conditions, doubtless will be on these boats. When they get an alarm to go to a fire, the pilot on the boat (the captain on the boat is the fire captain, and the man who handles the boat is called the pilot,) the pilot of the boat goes to the pilot house as quickly as possible and his engineer goes down below as quickly as possible. The men do not live aboard the boat, but live in a fire house ashore. The engineer then has got to start his circular pump, his air pump, his exciting set, and then his turbines. While the boat is lying at the dock, there is no water in the pumps, the sea cocks are closed. As soon as he gets the turbine started, the pilot with the controllers on each side of him in the pilot-house, can start one or both screws in either direction, without the necessity of the engineer having to answer bells or pay any attention whatever to the motors. The boat in her course down the river to the fire is handled entirely from the pilot-house.

Everything Controlled From Pilot House.

In a crowded narrow river, such as the Chicago river, it seems to me, and I am still very well satisfied, it will so prove, that there will be found a great advantage in handling the boat in that way. There is only one man in control, there is only man to be held accountable. If they should run into some other boat, or some other boat run into them, there cannot be any dispute between the pilot and the engineer as to who is to blame. It is up to the pilot, he is handling the boat entirely. In the pilot house he has a controller each side of him, very much like a street car controller, and he can move either screw at any speed, forward or back, singly or together, as he chooses. When they get to the fire all the engineer has to do is to open his sea cock and let the water in his pumps. If, during the time that the pumps are in operation, it is necessary to move the boat, the generators and the motors and turbines will stand the temporary overload without any difficulty. It is never supposed that the boat will have to run full speed and pumps at full capacity, at any one time. It is not probable that they ever will. If, during the progress of the fire, the fire captain in charge, wants to get, instead of 145 gallons through each pump, at 150 or 160 pounds pressure—if he wants to get 300 pounds pressure, in a single powerful stream, the pumps can be compounded, and the water can be shut off at the sea cock of the port pump, and the charge of the starboard pump turned through the port one, thereby giving about 5,000 gallons a minute, at 300 pounds pressure of the pump, without stopping the turbines or any danger from the increased pressure. In a centrifugal pump, if all the outlets are suddenly, when the pumps are discharging water, the pressure does not go up to as large an extent as in the piston pump. It rises slowly.

When the fire is over and the services of the boat are no longer required, all the engineer has to do then is to shut off the sea cock. He does not have to stop the turbines or anything else, and he shuts off the sea cocks, and the fact that the boat is going back is nothing to him; in other words, there is no attention which he must pay to the motors in any way. The first of the two boats which are to be built, we have had out twice. She is now on her way from the place where she was built, to Chicago, and both times when we

have had her out she was handled by a lake captain who has had much experience in handling twin screw car ferries on the lake, and he expresses himself as being pleased, thoroughly satisfied, delighted, with the way in which the boat could be handled.

There is practically only one other point about the boat which is somewhat unusual, and that is the matter that has to be tested out. It is not known really whether it will be a good thing or not, and that is the dredge spuds which are fitted to the boat. Since the drainage canal was opened in Chicago, the current through the main river and through the south branch sometimes runs from three to four miles an hour. If a fire should take place in a grain elevator, for instance, right on the bank of the river, it is possible that the boat would find no place she could tie up to on the same side of the river, where she could reach the fire with her streams. It might very well be, at the particular point that a fire happens, that the other side of the river is too far away, and it would be difficult to hold the boat against the current in one position. We therefore fitted in the boat these steel hollow dredge spuds, two forward and one aft, as shown in the drawing, and the idea is to run them down until their pointed ends strike into the bottom of the river. They can be run twenty-four feet below the surface of the water, and the usual depth is twenty feet. It is supposed they will be very useful, but that remains to be seen.

Mr. Edward P. Bates: How many miles of the river is suitable for dockage from the lake, inland?

Mr. Babcock: I should say ten or twelve miles altogether. There is one thing I am very happy to say I could sue Captain Kenlon on, and that is the position for the suction of the pump.

Discussion by F. M. Wheeler.

Mr. Frederick M. Wheeler: I would like to ask a question, and drop a little thought in regard to the matter of this loss of pressure between the pump and the hose nozzle. I have studied more or less the subject of currents in piping, but I have been surprised to learn how little there is recorded in that connection, very little experimenting, and very little written on the subject. It is one that is full of interest, and I hope sometime to institute some ex-

periments with glass tubes to show the effect of different currents in piping. I ask what was the character of the piping between the points? Also, the character of the stream of water as it was delivered by the pump into the pipes? We all know that it is very easy to deflect air currents and sometimes hard to put them back again to their initial direction. When once you establish an air current, it is apt to keep on that way, and with the water it is still more so. If water enters a pipe in a spiral manner, a pipe of a certain size, it is apt to continue that way, and it is easy to deflect it. You see it in streams and brooks, which is the effect of eddies and suction. Take a pipe, it may have certain kinds of rings that will establish certain kinds of currents. If we could get inside of the pipe and see for ourselves what is going on there, we would give up wondering why we get certain results. When we have right angle connections, like a T and two streams going together, we do not wonder why we have a jarring. I would say that there is too little use of these generous elbows and Y connections, and for economy, or want of space, we are apt to use right angle connections, like T's, much to the detriment of the coal pile and the material of the pipes and pumps.

It occurred to me that the character of the stream itself, as delivered by a reciprocating or centrifugal pump, varies, and it is noted by the character of the pipe, design of the pipe, and the obstruction of the characteristics of the inside of the pipe. I have seen a hose thresh around and maim people within reach. I would like to see some one who would really investigate this thing in a scientific way, the influence of currents in pipes. I once experimented in the American Society of Mechanical Engineers with a plain goose-neck, by doubling up a goose-neck, and establishing the current through one side by obstructing the other side, by simply putting your hand over the mouth, and then removing your hand, and no water would come out of one end for hours. Reverse the operation, and it would go the other way.

The German Reichstag passed a bill Feb. 15 authorizing an annual subsidy to the North German Lloyd Steamship Co. of \$125,000 for opening up a line of steamships between Singapore, New Guinea and Australian ports.

IMPORTANCE OF TERMINALS AT NEW YORK.

In the State Waterways Conference, held at Brooklyn, N. Y., recently, the New York State Waterways Association was formed to succeed the older organization.

The meeting of the conference proved to be a good one and it is the hope of the members that it will be able to accomplish much in the coming year toward the betterment of New York's waterway facilities. The most widely discussed subject was that of terminal facilities at New York, without which it is certain that port cannot hope to regain much of the traffic which, though hers by right, has of late been diverted to other cities. This movement for better terminals has been carried to the legislature, where bills are before both branches providing for an investigation by a commission concerning the conditions prevailing at the ports of New York, Buffalo, Oswego, Whitehall and Tonawanda, after which the commission will make a report to the governor of the state.

With regard to appropriations for terminals, it was brought out in the course of the discussions at the conference that the main appropriation of \$101,000,000 voted for the barge canal makes no provision for the acquisition and maintenance of terminals in connection with the ports at either end of the canal. It was stated by speakers that owing to the careful preliminary investigation the contracts for the canal, about one-third of which so far have been let, are well within the estimates and a saving of as much as one-fifth may be made on the original sum allowed by the legislature. It is suggested that any savings of this nature should be laid aside to go towards expenses incurred for terminals and other improvements, such as the construction of lift or swing bridges which it may be found desirable to substitute for fixed railway bridges.

The executive committee has already before it two practical questions for early consideration. One is the quicker and cheaper transportation of coal from coal fields by the improvement of waterways now obsolete or antiquated, with some necessary canalization so as to give access to the terminals at Buffalo through the up-state lakes and to New York by direct communication with the Hudson river. What is wanted is the standardization of canals to allow the passage of the biggest units that could traverse the entire system. The maximum size of

such barges would be 2,400 tons, length 308 ft. over all by 43 ft. beam and 10½ or 11 ft. draught, suited to lockage adapted for future requirements on a concerted comprehensive plan.

The second question that has arisen prominently from the conference discussions is the removal of restrictions and obstacles through the bridge structures now proposed which prevent the passage of craft from the great lakes to the sea or vice versa if fitted with masts, derricks and the like above-deck structures. This is of great importance to owners of steam and other lighters whose dimensions are well within the limits above given and also to owners of large yachts who are asking why they should be prevented from taking their craft through the whole length of the canal without unfitting their masts or derricks. If there are to be standard fixed bridges of the ordinary railway type, such free passage will be utterly impossible. If, on the other hand, lift or swing bridges of the bascule, "jack-knife" and similar types, such as are used in canals of modern construction, like the Manchester ship canal, and in the French and German systems, are substituted for fixed bridges, arbitrary height regulations will not be necessary and canal traffic will proceed with a minimum of delay on the great lakes, where bridges open to allow the passage of 10,000-ton freight steamers, causing little slackening of speed.

MOVING THE STEAMER VASHON.

In connection with the repair and enlargement of the old stern wheel steamer Vashon by Philip D. Sloan, Seattle, it was necessary to move the boat about 6 ft. to one side and to swing her through an angle of 15 degrees before commencing the work. The details of the process employed in moving and swinging the boat may be of interest.

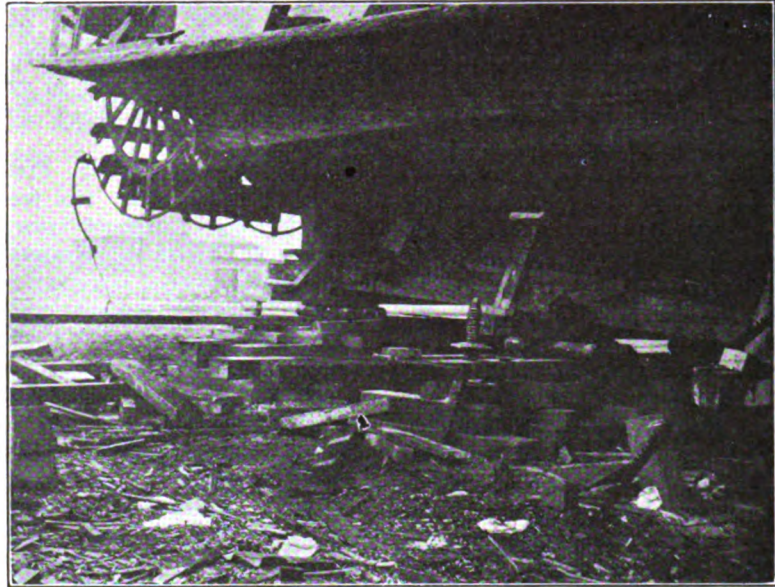
The Vashon is a standard Puget Sound stern wheeler 127 ft. long by 22 ft. beam and 7 ft. deep. Her registered gross tonnage is 244 and the net is 138.

After being hauled out of the water a cradle of 12x12 and 12x14 in. timbers was built under the hull. This cradle was supported on 9 timber cribs built of 6x6 and 4x4 in. cribbing.

Thirty-six jacks resting on these cribs were used to raise the boat and to assist in swinging her.

On the top of each cribbing was laid a floor of heavy planking on which ran 6-in. wooden rollers that carried the weight of the boat. On the third crib from the bow, about 45 ft. aft from the stem, the rollers

a point 20 ft. from the stern. A 5/8-inch steel wire cable reeved through blocks giving a triple purchase was used for hauling, one end of the cable being secured to the boat. Six men operated the capstan,



BLOCKING UNDER THE STERN OF THE VASHON WHILE MOVING.

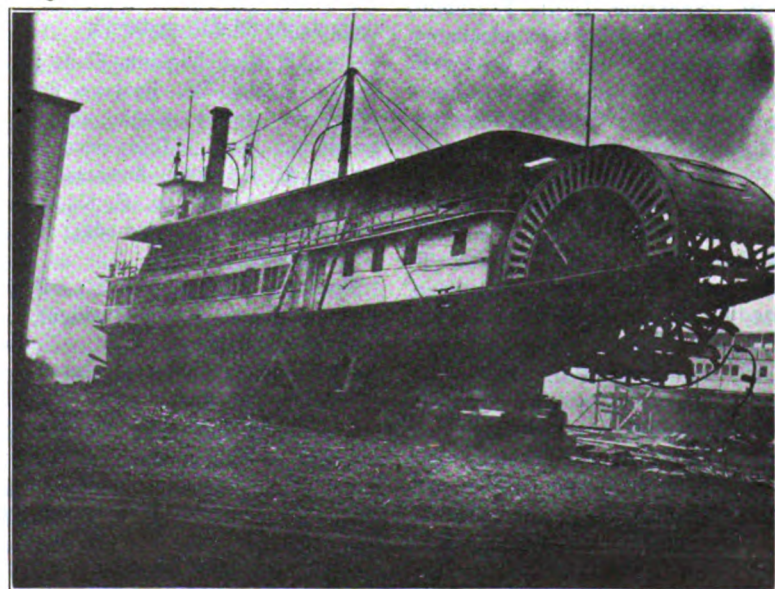
were arranged in a circle to form a pivot on which to swing the boat. The boat was supported by jacks while the rollers were being placed and replaced. Since the boat was moved to one side first and afterward swung, the rollers were placed with their axes parallel to the keel, the pivot rollers being arranged after the side movement had been completed.

To swing the boat a capstan was set some 50 ft. to one side opposite

the swinging at the same time being assisted by the jacks.

The entire job was completed in 16 hours, employing nine men. The cost of the work was about \$50.

At meetings of the board of directors of the Western Transit Co. and Rutland Transit Co., the following officers were elected: W. C. Brown, president; Walter B. Pollock, vice president; E. T. Douglass, general manager; E. L. Rossiter, treasurer.



THE VASHON READY FOR SWINGING.

Marine Engineer Association Elections.

No. 3, Detroit, Mich.: President, John L. Rossiter; vice-president, M. J. Gilligan; recording secretary, Geo. Patten; financial secretary, Frank Kenyon; corresponding secretary and treasurer, Albert L. Jones; representatives to national convention, Albert L. Jones, Wm. P. Tindall, Wm. Nolan.

No. 6, St. Louis, Mo.: President, Wm. L. Alberts; vice-president, C. E. Shrodes; second vice-president, H. G. Armstrong; secretary, F. A. Kremer; treasurer, Charles S. Jackson; trustees, George Williams, David Duffy, H. G. Armstrong; representatives, C. E. Shrodes, F. A. Kremer; conductor, Tony J. Costello; door-keeper, A. M. Jensen; chaplain, Harry F. Conley.

No. 17, Cincinnati, O.: President, Albert Johns; vice-president, Melvin Leep; treasurer, Daniel D. Farrell; financial, recording and corresponding secretary, George S. Collins; door-keeper, Eugene Smith; chaplain, Daniel D. Farrell.

No. 20, Memphis, Tenn.: President, John P. Bean; first vice-president, Ike W. Betts; second vice-president, John A. Bandy; secretary, Joe B. Barry; treasurer, John W. Prescott; district deputy, J. Fred Herndon; business manager, A. D. Coston.

No. 21, Vicksburg, Miss.: President, C. T. McAnnally; vice-president, J. P. Pendergast; financial secretary, J. W. Layn; corresponding secretary and treasurer, Thomas Tucker.

No. 24, Paducah, Ky.: President, J. H. Mix; first vice-president, Charles S. Johnson; second vice-president, Wade Brown; recording, financial and corresponding secretary and business manager, George M. Lee.

No. 26, Evansville, Ind.: President, John T. Zoll; secretary and treasurer, T. H. Kirkbride; chaplain, Oscar F. Sevint; district deputy and business manager, Charles Hickman; conductor, Edgar Easton; inner door-keeper, Wm. F. Rosenberger; trustees, Wm. January, John M. Wainman, Wm. F. Rosenberger; auditing committee, Edgar Easton, Wm. January, Wm. F. Rosenberger; examining committee, John M. Wainman, T. H. Kirkbride, Edgar Easton.

No. 30, Pittsburg, Pa.: President, Thomas C. Moore; first vice president, Milton D. M. Fairman; second vice president, John Bush; secretary and treasurer, George E. Ingram; representative, Thomas Skelton; chaplain, George C. Boli; doorkeeper, John B. Clark; conductor, M. C. Mason.

No. 35, San Francisco, Cal.: Presi-

dent, Peter G. Peltret; first vice president, Frank G. Graham; second vice-president, Wm. F. Mathews; treasurer, John S. Purdie; financial secretary and business manager, John J. Searey; recording and corresponding secretary, M. K. Anderson; trustees, Edward R. Brady, Walter Scott, J. E. A. Miller; representatives to national convention, J. Albert Reed, John J. Searey.

No. 38, Seattle, Wash.: President, W. B. Jackling; first vice president, Alex. McGregor; second vice president, J. W. Hartman; treasurer, H. W. Farmer; financial secretary, W. M. Coombs; business manager and corresponding secretary, C. S. Follett; trustees, W. A. Snyder, D. T. Cross, J. S. Wright; delegates to national convention, C. S. Follett, H. W. Farmer.

No. 46, Clayton, N. Y.: President, C. P. Sampson; vice-president, B. T. Farrell; recording secretary, C. W. Hollenbeck; corresponding secretary and treasurer, D. W. Farrell; chaplain, J. A. Cook; conductor, Charles E. Haas; door-keeper, Stephen Pelow.

No. 53, Marine City, Mich.: President, Wm. Fritz; vice-president, John Cannon; recording and financial secretary, John Conley; corresponding secretary and treasurer, H. Stone; conductor, Wm. Woods; door-keeper, Charles Brenner; chaplain, Marckus Hill; delegates to national convention, John Conley and Joseph Vallie.

No. 55, Cheboygan, Mich.: President, J. A. McDougall; recording secretary, W. J. Clark; financial secretary, J. S. Harrington; corresponding secretary and treasurer, A. Stalker; board of trustees, H. P. Roberts, P. Eustic, J. A. McDougall; representative, J. A. McDougall.

No. 62, New London, Conn.: President, George W. Fraser; first vice-president, Julius Koch; second vice-president, H. C. Albin; recording secretary, C. A. Gray; financial and corresponding secretary, F. K. Beckwith; chaplain, F. L. Edwards; treasurer, C. E. Edwards.

No. 87, Detroit, Mich.: President, Andrew Carter; vice-president, James Cameron; trustees, Fred C. Beatty, Wm. Scholes; secretary and treasurer, George B. Milne.

No. 93, Washington, D. C.: President, D. P. McCracken; vice-president, W. N. Corbin; corresponding and recording secretary, J. A. Watts; financial secretary, W. B. Hayden; treasurer, J. W. Fox; chaplain, J. P. Van Ostrand; conductor, C. J. Coggsell;

door-keeper, Chas. L. Nash; delegates to national convention, J. A. Watts and W. B. Hayden.

No. 100, Honolulu, H. I.: President, George E. Ward; first vice-president, B. H. Norton; second vice-president, Charles J. Lynch; treasurer, James W. Wilkinson; financial secretary, Walter H. Bromley; recording and corresponding secretary, H. G. Wootten; trustees, James H. Quinlan, A. V. Inman, James H. Leach, Daniel Ballew, J. Wagner; chaplain, Charles B. Cottrell; conductor, George E. Farnsworth; door-keeper, John Kelly.

No. 101, Norfolk, Va.: President, James E. Luck; first vice-president, C. H. Bond; second vice-president, J. H. Pease; treasurer, S. B. Turner; financial secretary, W. H. Luck; corresponding secretary and business manager, R. L. Gollet; recording secretary, W. L. Manning.

WHICH WAY WOULD THEY REVOLVE?

Frank Watkins, compass adjuster at Cleveland, who is conducting a nautical school at Midland, Ont., writes to the REVIEW as follows:

"I have an interesting item which I had given to me this winter in Belfast, Ireland. A steamer being launched end on, stern first, with propellers shipped but disconnected from engine, which way would they revolve due to action of water against them? The answer is, as if working astern. At first sight everyone says 'Why, as if engine were working ahead.' This is absolutely proved the opposite."

With a view to fitting the Charlestown navy yard for undertaking the building of a good sized battleship, one of the largest colliers or a smaller war vessel, Naval Constructor Elliot Snow has recommended to the chief of the bureau of construction and repair that an appropriation be obtained for erecting a great steel shiphouse and slip. While the cost is not made public, it is believed that it would be between \$150,000 and \$175,000. With such an outfit, the local yard would be able to undertake construction work similar to that now being done at the Brooklyn navy yard, where it has proved successful.

The Mallory line steamships *San Marcos*, *Comal* and *Colorado* are to be equipped with wireless telegraph at once. After this is done all the company's fleet will have the wireless aboard, as the other vessels have already been equipped.

RIVER STEAMERS FOR THE ARGENTINE.

Messrs. I. Thornycroft & Co. have recently delivered the S. S. "Paso de Obligado," the first of five river steamers of shallow draught and with other special features for South American river service, which they are building at their Southampton yard.

The steamers are building to the order of the "Marina Mercante Argentina," a company recently formed for developing navigation in that

The arrangements generally are such that the boats are particularly adapted for working in the very hot climate met with in the northern parts of the rivers. All five vessels will be navigated to Buenos Ayres under their own steam and their fuel capacity is ample for such a journey.

The "Paso de Obligado" has already arrived at Buenos Ayres. Her voyage was successfully made in 34 days notwithstanding the very bad weather which was met with from Southampton to St. Vincent. The

gua and Quiros; torpedo boat Rodgers, distilling ship Rainbow, supply ship Supply and the cruiser Yankee. The wooden tug Lincoln is reported as likely to require repairs in excess of 10 per cent of the cost of a similar ship of the same size and design and like material.

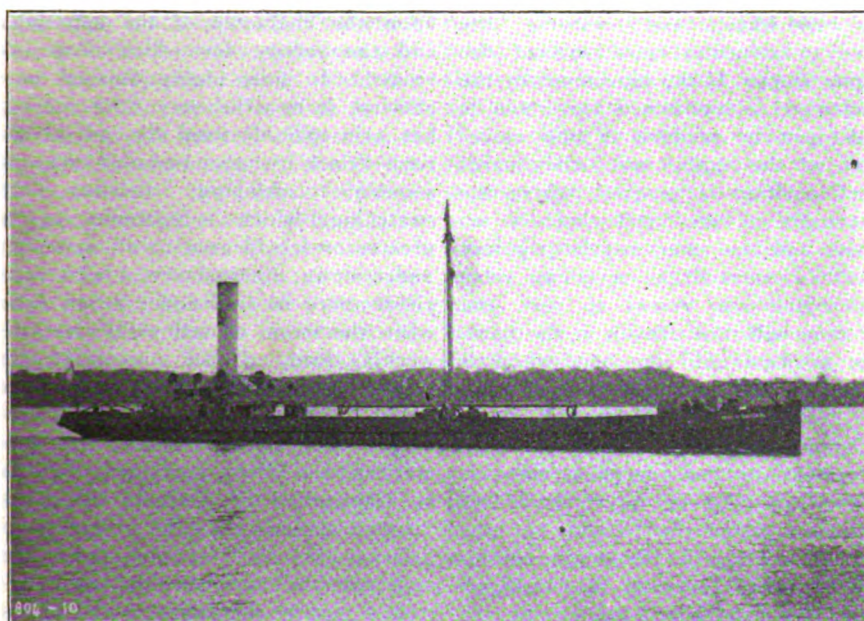
Secretary Newberry requests that the estimates of the board of construction, which accompany the communication, be provided for in the naval appropriation act for the fiscal year ending June 30, 1910. The total of the board's estimates for these repairs is \$4,154,500.

In a later communication the secretary adds the name of the tug Apache to the list of vessels to require general repairs. She will also be fitted with a new set of boilers at a total approximate cost of \$21,500.

LENGTH OF HAWSERS.

The new regulation of the department of commerce and labor limiting the length of hawsers between towing vessels and sea-going barges and also between such tows on the inland waters of the United States went into effect Feb. 1. Under this regulation tows of sea-going barges navigating inland waters shall not exceed four vessels, including the towing vessel or vessels, and hawsers are limited in length to 75 fathom. The regulations also provide that "tows navigating in the North and East rivers of New York must be bunched above a line drawn between the Statue of Liberty and the entrance to Erie basin. Where tows are entering Long Island Sound from the westward the lines may be lengthened out to the prescribed length after passing Fort Schuyler; and when bound for New York from Long Island Sound tows must be bunched before passing Whitestone Point." It is not unlikely that the result will be increased freight rates to points along Long Island Sound and New England.

Representative Small, of North Carolina, has introduced to the house committee on interstate and foreign commerce a proposal that instead of providing that the government pay rental with an option of buying after five years it should pay \$2,000,000 for the proposed lighthouse on Diamond Shoals, off Cape Hatteras, N. C., as soon as it shall have been completed and approved, the contractors to receive no moneys while the construction is in progress. Representative Small is the author of the bill for the purchase of such a structure.



RIVER STEAMER PASO DE OBLIGADO FOR THE ARGENTINE REPUBLIC.

and the surrounding country, and especially to tap the rich region through which the Parana, Uruguay, Paraguay and other rivers run. It is the culmination of the general desire by influential people in the Argentine to possess a line of steamers built for and maintained solely by themselves.

The dimensions of the "Paso de Obligado" and her sister vessels are 220 ft. in length, 33 ft. breadth, 8 ft. draught, and a speed of 10 knots is anticipated under ordinary working conditions.

The machinery is Thornycroft type twin screw, triple expansion, surface condensing; steam being supplied by two marine type return tube boilers.

The hull is built throughout of S. M. steel, and the vessel will be classed 100 A1 Lloyds.

To facilitate handling cargo several powerful winches will be installed on each ship, while to provide for the lengthy freights—such as timber, etc.,—specially large cargo hatches have been made.

fuel consumption was extraordinarily low. The sister boats "Paso de La Patria," and "Paso de Cuevas" have also left the Southampton works and will shortly arrive at Buenos Ayres.

NAVAL REPAIR ESTIMATES.

Secretary of the Navy Newberry has sent letters to the house of representatives and to the senate in which he submits recommendations as to repairs of naval vessels for the fiscal year ending June 10, 1910. He reports that the following will require overhauling to the extent of \$200,000 or more: Battleships Maine, Missouri, Ohio, Wisconsin; protected cruisers Chattanooga, Cleveland, Denver, Des Moines, Galveston and Tacoma. He also states that steel vessels which will require repairs during the same period, the repairs to which will aggregate—under all bureaus—in excess of 20 per cent of the total value of each of the vessels, and which should therefore be authorized by congress are: Gunboats Concord, Yorktown, Elcano, Para-

The Steering of the Ship.

When ships were steered by hand, that is to say, when the hand of the steersman felt every variation in the strain upon the tiller, steering was an act giving opportunity for the exercise of the very highest degree of personal skill, and was in no sense mechanical. It was also laborious and for this reason spurred man's inventive faculties to the devising of easier methods. In sailing ships the strain upon the steersman was very severe, but as the steering must be done from aft where the steersman and watch officer can see all the canvas, the application of the screw gear to the rudder head was easy and may be said to be the first step to mechanical methods, by which is meant the intervention of some appliance between the wheel and the rudder whereby the movement of the former could be communicated to the latter without the steersman having to withstand the actual strain. This then made it necessary for the steersman to actually shift his wheel in order to ease the rudder, whereas with the older method the wheel would run amidship of itself if released.

New Set of Conditions.

The advent of the steamship introduced a new set of conditions in which the steering of the ship from some point considerably forward of the rudder, and the indirect leads, necessitated the use of some form of tackle, with or without a purchase, and the gear again became non-mechanical, the hauling parts of the tackle being rove over the drum of the steering wheel. As ships grew in size and power some form of mechanical steerer became necessary and steam was the obvious agent. Hence the steam steerer, which is mechanical in the fullest sense of the term, since the steersman does no part of the actual labor of steering the ship but merely controls as to direction and amount the force which actually does the work. The steam gear is met with in various forms but these remarks apply to all those in general use in lake ships.

The steering engine, of whatever type, is designed to run in both directions, and is controlled by the "reversing-valve," which is operated through the hand wheel in or on the pilot house. The man at the wheel can do nothing more than shift this valve; he has no direct connection with the steering gear proper, but by careless use he can wreck the best

designed and installed gear ever made. It should never under any circumstances be shifted suddenly or too fast; there is no occasion for it except in the most critical emergency, and even then it is quite possible to shift it more rapidly than the engine can keep up with it. As he shifts his wheel, and through it the reversing valve, the engine follows, and through what is known as the "righting gear" overtakes the movement of the hand-wheel and restores the valve to a neutral position and the engine stops. If the movement of the hand-wheel is continued the valve is held open in advance of the movement of the engine until the "hard-over" position is reached, where the movement of the hand-wheel is arrested and as soon as the righting gear has centered the reversing valve the engine also comes to rest, and the gear will now remain in the hard-over position until the hand-wheel is moved in the opposite direction.

Hand Wheel Movement.

Communication of the hand wheel movement to the reversing valve is effected in various ways, dependent somewhat upon the location of the steering engine; if the engine is located forward a shaft leads direct from the hand-wheel column in the pilot house down to the engine; if located aft this shaft, through a pair of miter gears, operates a horizontal shaft leading athwartship and carrying a drum which is connected by small wire cable with similar drum and shaft and gears aft at the steering engine, or sometimes a shaft transmission is carried clear through to the engine, and in a number of the most recent ships the "telemotor" is employed. Briefly described the telemotor consists of two small cylinders, usually about 2 in. diameter, and within which are leather-packed pistons. One of these cylinders is mounted in the pilot house and its piston is operated by means of the hand-wheel; the other is located at the engine and its piston is connected to the reversing valve. The two cylinders are connected by pipes and the whole system is filled with oil, so that a movement of the piston of the forward cylinder causes a corresponding movement of the piston of the after cylinder and, through it, of the valve.

Whether the engine is placed forward or aft connection is made to the quadrant or tiller by means of chains or chain and wire rope, which is over-

hauled by the movement of the engine.

These details, while common in one form or another to all installations and therefore well known, are necessary as introductory to what follows:

In all mechanical movements and devices the freedom of movement of the various parts and members with relation to one another unavoidably involves more or less "slack" or ease of fit, the amount of this depending upon the character of the apparatus and the service for which it is intended. In fine, highly finished machinery, it may be very little indeed, but is inseparable from all, and in this term "slack" is also included the unavoidable springing, twisting, or stretching, which is common in a greater or less degree to all materials under strain; for instance, a wire rope yields more or less under strain even when the strain is well within its safe working load, and the amount of this yield or stretch is dependent upon its length, and when the strain is removed immediately resumes its former state. When movement has to be transmitted in alternate directions through a series of parts with ever so little of this slack at each point, the aggregate as between the two extremes may be considerable and rapidly increases with even very slight wear.

Aggregate of Lost Movement.

Applying this to our steering gear, and particularly to that part of it from the hand-wheel to and including the reversing valve and righting gear and which must move easily by hand, we find an aggregate of lost movement which, added to the slight "lap," or amount that the valve must actually be moved before admitting steam to the engine, requires a considerable movement of the hand-wheel before the engine actually moves at all. Even in new gears and with the engine forward (the most favorable situation so far as lost hand movement is concerned) this is rarely less than 60 degrees (one-sixth revolution), it is generally 90 degrees (one-quarter revolution), and with the engine aft and with either wire cable, shaft or telemotor transmission is generally still more. Besides this, there is a certain amount of slack in the tiller chains, and, with the engine forward, in the wire rope leads between the quarter-blocks, which has to be taken up by the engine before the rudder is shifted at all and which calls for still more

hand-wheel movement. This is true with all gears even with all practicable slack taken up at every point, and with slight wear or inattention it is still more. There are more instances of a half revolution of lost movement than otherwise.

Now for the result. No ship, left to herself, will keep a straight course; her tendency to vary from it depends largely on her trim, weather, depth of water, etc., and if the wheelsman relies entirely upon steadying her with his wheel, the amount of slack has everything to do with his success and the inevitable tendency is toward giving "too much wheel." Too much starboard wheels means still more port wheel to stop her swing, and vice versa, and the result is what sailors call "laying rail fences." The man at the wheel has no control of the rudder within the total angle of lost movement at the hand-wheel, although, as will be shown later, the amount of this lack of control can be greatly reduced, and the ill effects of that which is unavoidable can be minimized by the exercise of a little judgment. Many a ship has been given a bad name when the whole trouble lay in the sluggishness of the gear which an understanding of the problem would cure.

Steered as Well as Propelled.

Now let it be borne in mind that, practically speaking, the steamship is steered as well as propelled by the flow of water from the screw. The rudder merely diverts a portion of this energy to one side or the other as is made manifest in swinging the ship, without any headway whatever, by simply shifting the wheel. Now therefore every time the wheel is shifted in steadying the ship on her course, a proportion of the power which should be used in driving her ahead is diverted to shifting her sidewise, and is most inefficiently expended besides. So that the total loss due to poor steering is not only the increased distance traveled but the loss of time and of power due to driving the ship broadside to, and this loss is very much greater than is generally supposed. Let us take a common case and see what it amounts to in actual figures. Almost any wheelsman will say that if he keeps his ship steady within one-eighth point either way, or a total swing of one-quarter point, he is making a good course, and so he is, judged by the average; the total swing is more likely to be double that. Suppose we have a ship 500 ft. long; her length then is one-half the diameter of a circle of which the circumference is 3,140 ft. The number of one-eighth points in a circle is 256, so that if our

ship has swung off one-eighth her stem is $12\frac{1}{4}$ ft. off the line. Before her swing has been stopped she has head-reached so that she has increased this distance materially, let us say to 15 ft., because at say, 12 miles per hour, she travels her own length in 28 seconds. Now in shifting the rudder it is the stern of the ship that swings, not her head, so that when our ship is once more headed correctly by compass she is bodily 15 ft. to one side of the line on which she was headed when she started her swing, and the power that put her there is just exactly that much deducted from useful propelling effect and can be made neither more nor less. Now she swings off the other way perhaps and the process and loss is repeated. If the swing is anything greater than the eighth we have supposed the loss is proportionately greater; if it is a quarter-point the loss is at least doubled, perhaps more because more wheel will be given and then eased off. It is not at all uncommon to see a ship swing off thus once every five minutes, 12 times in an hour; it has been actually observed and timed at 18 times in one hour on a 500 ft. ship in fine weather for a total average swing of three-eighths, or three-sixteenths either way, with what would be called fair steering. Scores of ships are much worse than this.

Aggregate of Broadside Movement.

Suppose we are making an 18-hour course at say, 12 miles per hour, and suppose further, that we keep within a total swing of 20 ft. and that it is all to starboard, say, nothing to port, and that she swings thus once in five minutes. At the end of 18 hours she will have moved bodily broadside-to over eight-tenths of a mile.

Now it may be argued that this is an impossible, or at least an improbable, case, but it is really not uncommon. Many wheelsmen have the habit, unconsciously perhaps, and perhaps for the same reason that a person lost in the snow will invariably travel in a circle, and as a matter of fact one of the most common of orders is "nothing to port" (or starboard, etc., as the case may be). Independent of the loss of time and power in placing a ship so far out of position even with fair steering and in good weather and without external influences, it is not hard to understand how a ship is occasionally far astray in fog, smoke or snow, and with the assistance of winds or currents. The error in position may or may not occur, but the loss of time and power straightening up the ship is absolute, and the distance moved through is the same whether it

is all to one side of the line or crossing and recrossing it.

Reducing Lost Movement.

Let us see what can be done to better these conditions. We cannot do away with the steam steerer and we cannot eliminate *all* lost movement, but we can reduce it to the very least possible for easy movement. See that there is no play in the gears in the column or shafts, these should be cut in all cases and meshed as closely as possible, see that all bearings are as snug as they can run (except in the case of the intermediate bearings of an all-shaft transmission, where free movement does no harm) without causing undue twisting strains; the wire transmission cable should be kept taut and all fairleads free and liberally lubricated; if there is play in the threads of the sleeve on the steering engine it should be very carefully taken out as a slight amount of slack here makes a great deal of movement at the hand-wheel and most steerers are provided with double nuts for making this adjustment; if the pins and knuckles in the valve movement and righting gear are at all slack have them refitted; see that in the leads from the drum of the steering engine to the quadrant there is no slack, and if the gear is properly put up it should run from hard-over to hard-over without producing slack at any point; if the engine is forward and a wire rope is used for the leads between the quarter-blocks, it should be under strain so that when one part is holding the rudder over the other part should not be slack; in fact this strain may be equal to that of holding the rudder hard-over without imposing additional duty on the rope; if the steerer is worm-gear see that there is not more than enough play between worm and wheel for easy working; in short wherever there is movement see to it that it takes place with the least possible loss.

Making Needful Adjustments.

Now be sure that the midship position of the wheel and the steerer coincide absolutely, and if not make the needful adjustments which are simple and easily and quickly done. See that the rudder stands perfectly fore and aft with gear amidship. When the ship leaves the yard this is generally in good shape but chains and ropes do not stretch equally and slack may have been taken up unequally and the rudder may have touched a dock. A ready means of correcting this is by means of a straight-edge batten applied to either side of the rudder and reaching to the stern-post. If not right adjust the turnbuckles in quadrant chains. When these points are attended to

it will be possible to see what can be done towards steady courses.

Ninety-nine out of every hundred ships if left to themselves with a rudder amidship, in good weather, will work to port, on account of the action of the screw, which is equivalent to saying that they carry a certain amount of port wheel. Now, bearing in mind what has been said about unavoidable slack, or lost movement, the problem is to keep this slack all in hand and at the same time give the ship just what wheel she needs to counteract the tendency to work to port. The instant that she is given more than this and has to be steadied, the control of the rudder is lost to the extent of the total angle of lost movement in the wheel. Therefore give port wheel very gradually and slowly until her swing is just met and steadied, keeping all slack to one side of the gear. Don't be in a hurry, take plenty of time and give her little by little until the steady point is found. Now the slack is all in hand and the engine is just holding its own, and there is no reason why, external conditions excepted and so long as the speed is unchanged, the ship should not keep an almost absolutely steady course. Having noted the position of the wheel carefully (not the pointer), as she is probably something to port while the foregoing experiment was making, it will be necessary to give a little more wheel and send her a little to starboard and then meet her as she works back, and a few attempts and a little patience and judgment will soon show what wheel should be carried under almost all conditions and enable the wheelsman to put her on a course and steady her in a few minutes without continual rolling of the wheel, and the result will be better time, less coal and cussing, and more assurance to the master in thick weather. The main point to be remembered and emphasized is that *a steady ship can never be had with the rudder to all intents and purposes adrift to the extent of the lost movement at the wheel*, because there is no possible way by which the wheelsman can tell where his rudder is within the total angle of that lost movement, which may be anywhere from 90 degrees up, depending upon how carefully the slack has been eliminated.

Loss of Time and Power.

An investigation of the amount it is necessary to shift the wheel of the average ship in order to actually change the direction of movement of the rudder would probably produce some surprises, and this means not only constant loss of time and power

and wear and tear of gear, but additional risk and probably occasional actual damage.

To assist in making this clearer let us suppose that everything is amidship, rudder included. Suppose we starboard a little; we roll the wheel 90 degrees (one-quarter turn); we have just taken up all slack, including the quadrant chains, but we have not moved the rudder yet; in order to do this we must give more wheel, say another 90 degrees, or a total of one-half turn. Now, will rolling the wheel back again one-half turn put the rudder amidship again? By no means. It required one-quarter turn to take up all slack in one direction only; it would require the same amount to take it all up in the other direction, and when the wheel is rolled back a half turn all that has been done is to take up the total lost movement, and

to bring the rudder amidship again an additional quarter turn must be given. But we now have the rudder amidship and all slack in hand with a port wheel of 90 degrees, and to restore the conditions under which we started the wheel should be starboarded just that much. It is hardly possible for a wheelsman to keep in mind the various shifts so long as he is continually crossing and recrossing the course. He may have his rudder amidship with considerable port or starboard wheel, or his rudder may be to port or starboard and his wheel amidship, and since this cannot be entirely eliminated, as has been pointed out, the only way to reduce its effects is, first, make the gear as taut and snug as possible and, second, endeavor to steer with the slack all in hand, which practice and patience will make possible.

The Hydroplane Ship.

The idea that a great increase of speed at sea could be obtained by giving such a shape to the hulls of ships that the action of the water itself would, as they proceed through it, lift them bodily, and thereby effect a comparative reduction of resistance is by no means new. Naturally a great waste of energy occurs in a ship in raising a wave on each side, which is due to the fact that the present form of hull of all vessels is a modification of a wedge driven through and dividing the water to that depth which the vessel is said to draw. Since the earliest days of steamships, propositions have been put forward for substituting for the present form of hull a flat bottom sloping gradually upwards at the bows, but although in theory great speed could be attained with a vessel built along these lines, in practice no stability could be expected, and at a very early velocity the boat would become unmanageable.

Early Experiments.

An important step in the right direction was, however, made when an English clergyman of the name of Ramus, of Rye, in Sussex, conceived the idea of using two inclined planes, one at the forward end and the other at the after end of the vessel. These planes were placed in such a position in relation to each other that at speed the vessel was lifted equally fore and aft. The British Admiralty were so far convinced that an important discovery had been made that they submitted several models built on lines

laid down by Ramus to test in the experimental tank at Torquay. These tests gave very remarkable results. By the aid of rockets, speeds were obtained which had never been approached before, or perhaps since, the models, moreover, maintaining their proper trim throughout. Models experimented with, built to the ordinary lines of a boat, were invariably found to dip their noses and turn over before the full velocity of the rocket attached to them was reached. Notwithstanding, however, the Admiralty officials were, apparently, not satisfied that the results obtained were relevant to the operation of the principle on a large scale, and we find them throwing cold water on Ramus's subsequent optimistic suggestions for modifying the standard hull shape.

Motor Hydroplanes.

This was in the year 1872, and at that time the marine engine was far from being the perfect machine it is to-day. Moreover, the screw propeller, which would very materially assist in the practical application of the inclined plane principle, although invented, was looked on askance by marine engineers. Had the development in marine construction permitted of a small vessel, say of about 20 ft. in length, being constructed, it would at least have served a very useful purpose from an experimental point of view, and it is interesting to speculate what the results might have been today. That Ramus was on the right track is evinced by the number of small vessels termed "hydroplanes"

which are being manufactured in ever-increasing numbers in England and on the Continent at the present time, and to which the motor admirably lends itself as a propelling agent. These hydroplanes have been so far mainly constructed for racing purposes, and remarkable speeds have been attained on comparatively very low power.

High Speeds.

It is necessary to consider more fully how this high speed is accounted for. As the boat is propelled through the water, the fluid which strikes any portion of the oblique surfaces must either be driven vertically downwards, or it must escape laterally, or it must lift the boat vertically upwards. If we consider the water as irremovable, the vessel would of necessity be compelled to rise over it, but the water is removable, and will escape laterally if time enough be given for its removal. Consequently, when the boat's speed is low, the water has time to escape to one side or other of the boat, and no lifting takes place, but as the speed increases the time in which the escape of the water must take place is shortened exactly in proportion to the velocity of the vessel; and as less and less time is given for the escape of the water, less and less of the water escapes from under the inclined planes, and the water which cannot escape becomes a firm support over which the boat glides. Moreover, the action of the hydroplane surface on the water creates a partial vacuum beneath each surface, and behind the step or the preceding one, this air suction being caused by the friction and commotion of the water drawing the air in at the point of contact with the surfaces. Air being 800 times lighter than water, it neutralizes the frictional contact between the water and the inclined surfaces, preventing to a considerable extent the drag or rolling action of the water which absorbs so much power.

Thirty-Four Miles an Hour.

It is not conceivable, nor in conformity with development along any branch of science, that hydroplane boats will be limited to racing machines, and already an American, now resident in France, by the name of Fauber, has constructed a boat on this general principle which will carry six men at the phenomenal speed of 34 miles an hour. It is only 26 feet in length and has a motor power of 60 horse. In a speed test with a smaller number of passengers this speed was increased to 37½ miles an hour. It is only necessary to re-

member that motor racing boats of nearly twice the length and six to eight times the horse-power have rarely ever approached this speed. If six, why not twelve passengers, and if twelve, who is wise enough to prophesy where the development will cease? The Fauber hydroplane, above water, has the appearance of any well-designed craft, the bottom consisting of a number of planes conforming to the shape of the sides of the boat. These planes have a V-shape in cross section, which enables them to enter the water without shock, and also to create a pathway or "berth" through the water, the V-shape surfaces beneath the bow having a sharper angle than toward the stern. Independent observers who have been in the boat testify to its extreme steadiness when running at top speed.

Hydroplane Motor Torpedo-Boat.

Based on his experience with smaller vessels, Fauber has commenced the construction of a hydroplane motor torpedo-boat which, although only 50 feet in length, and with a motor power of 350 horsepower, he is sanguine will attain a speed of 40 knots. This is rather in the nature of a torpedo-launch, and is intended for conveyance on the decks of cruisers or other war vessels, and to be put afloat only when required, as has been advocated recently with high-powered motor-boats of the Yarrow-Napier type. The great utility and advantages of the hydroplane are at present undoubtedly little understood by the majority of naval engineers, as are also the principles and many complicated and technical problems in connection with it, which must be worked out and proved by experience. Like the screw propeller, it is a very simple-looking affair to the average person. It is only the experienced designer and builder who fully appreciates the hundred and one problems that enter into their design and construction. It may be, however, that we are on the eve of as great a change in our commercial existence as was wrought by the introduction of steam-driven vessels, or when Dædalus, or some other inventor, first hoisted a sail on board his boat and trusted it to the breeze.—*Shipping Gazette*, London.

The house of representatives on Feb. 16 passed under suspension of rules the bill providing for the equipment with wireless telegraph apparatus of ocean-going vessels and those engaged in the coastwise trade.

PACKAGE FREIGHT TRADE

Buffalo, N. Y., Feb. 23.—The increased tonnage in the package freight trade on the lakes provided by the building of an Anchor and two Mutual line steamers this winter is no doubt a surprise to the marine interests in general, for the package freight lines have complained of poor business for quite a long time, and they suffered last season about the same as anything else on the lakes. Inquiry discloses the fact, however, that no increase of tonnage is contemplated, for the Anchor line still has some small steamers that it will probably sell and the Mutual line has usually chartered two or three boats to make up its full fleet, and this will not need to be done when the new steamers are ready.

The Western Transit line, the other large package freight concern operated here, also has small steamers that it did not use last year and likely will not again. Of late years there has been such a radical change in the management of this branch of lake trade that small steamers are of very little account in it. They carry only about 1,500 tons to 6,000 tons of the new class steamer, while it takes about the same crew and nearly the same amount of power to run them.

When the effort was first made to increase the size of these steamers, the Anchor liner Susquehanna being a pioneer in this undertaking, it was doubted on the part of some managers whether the venture could be made to succeed, for it was feared that the terminal facilities here and elsewhere were not suited for the handling of such cargoes, but as soon as the test was made something was done to adapt the vessels to their docks and now the Susquehanna is far from being among the largest of vessels of this class, as the aim is to run the capacity up to 6,000 tons, which appears to be about the limit, so long as shore facilities remain what they are.

There is at present no particular change reported in the management of this fleet, except that the Rutland line of the New York Central will now be managed in Buffalo in common with that company's Western Transit Line, who plan to bring the Rutland line boats to Buffalo quite commonly, in which case they can load down full depth from the upper lakes, take off part of their cargoes here by way of lighterage and then be deep enough for the Welland canal, reversing this operation on the up-bound trip.

JOHN W. CHAMBERLIN.



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MARINE REVIEW AS A MONTH- LY PAPER.

Change seems to be the spirit of existence. The old order giveth way to the new. Evolution marks the progress of man and of institutions. Old tools are scrapped for new ones. That which is adequate today may be obsolete tomorrow. Men and institutions must ever be ready to adapt themselves to the new order of things.

The progress of evolution has nowhere been more marked than on the great lakes. The way of doing things has completely changed during the past decade. The docks are not the same, the ships are not the same, and the unloading machines are not the same. All is new. The great business of the lakes, formerly marked by the most violent fluctuations in freights, has become as stable in rates as the great railroad systems. The keen and lively interest exhibited in the daily charter of steamers has entirely ceased. Steamers are now chartered by the year and the rate is firmly established long before the ice is

out of the rivers. The wild rate has become a minor matter.

Moreover, on the seaboard the changes have been equally significant. The coast-wise carrying trade, especially in relation to bulk freight, which was formerly a sailing proposition, is fast being taken over by steam. Machinery is now almost wholly employed where formerly hand power sufficed. This is true equally of the terminals as well as of the ships. The modern steamer is a complex mass of machinery with auxiliaries, either steam or electric, for every conceivable purpose. Docks are fitted with traveling cranes and elaborate loading and unloading machinery.

The change is fundamental. Noting these profound changes, the MARINE REVIEW for two years past has seriously considered whether the great field which it occupies could not be more competently covered in a complete, abundant, well illustrated, large monthly edition than in a weekly, which must of necessity be of limited size and somewhat hasty preparation. It has concluded to supplant the present weekly with a monthly edition that will cover exhaustively all the issues that have hitherto been handled in a more or less summary manner by the weekly. The first issue of the monthly will appear on April 10.

Obviously the proposition is an engineering one throughout and the purpose of the MARINE REVIEW will be to present these engineering topics in a manner which has not hitherto been approached by any publication devoted to the subject. None of the features of the weekly will be sacrificed, but all of them will find a place in the monthly, affording a more thorough and at the same time a more convenient chronicle of events, both on the lakes and coast and throughout the world. Naturally its scope will be larger than it has ever been. No phase of marine engineering will be left untouched, no phase of lake or coast development will be neglected, while the departments devoted to the drafting room, both hull and engines, to the machine shop and the mold loft, will be filled with fresh and useful information.

The subscription price will be \$1 per

year. Subscribers who have already paid in advance will have their subscriptions extended.

THE MOTOR BOAT SHOW AT MADISON SQUARE GARDEN.

The fact that every available square foot of floor and gallery space in Madison Square Garden was taken by boat, engine or accessory exhibitors for the New York Motor Boat Show, that the attendance of visitors far exceeded the total of motor boat shows of the past, and that the results are reported by the exhibitors and the management as highly gratifying is sure proof of the importance of this comparatively young industry in the United States. The fact, also, that a considerable number of the visitors made searching inquiries as to the seaworthiness of certain types of craft, looking more to the staunchness of the build and strength of the engines than to the elegance of appointments and machine shop finish, would point to the awakening of the general public to the merits of the gasoline engine in commercial life.

From a 47-ft. gasoline cabin launch designed for inland water use to an 18-in. electric launch model, the boat exhibits were such that the most rapid type of speed-crank, the lover of luxury and the modest runabout seeker could not but be satisfied.

Several splendid cruising launches were exhibited, the largest being noteworthy for completeness of detail in fittings and roomy passenger quarters. This type of craft, though large and of high power, was usually so arranged that one man could control the movement of the vessel. A 20-ft. fishing or shooting boat, designed especially for those desirous of possessing a craft capable of standing some rough handling and rough weather, proved to be another interesting exhibit. A 3-H. P. motor supplies the power, the boat being large of beam and roomy. Every imaginable type of small craft, down to motor-propelled canoe and dory were exhibited in abundance.

The exhibit of racing and speed boats was quite in keeping with the other exhibits of the show, one vessel, the

Den, being no newcomer in the sport of motor boating. A 25-ft. racer exhibited by the same builders also promises to improve on her showing of last season. Several speedy boats, not especially designed for racing, were exhibited by the various manufacturing concerns.

One of the most interesting exhibits of the show, however, was a hydroplane built by a western concern and placed on exhibition on the main floor, apart from the concern's large boat and engine exhibit. This hydroplane is 21 ft. in length, with a beam of 5 ft. 6 in., and is claimed by its owners to have attained a speed of 46 miles per hour. The original craft of this type made 45 miles per hour with a 40 H. P. engine on the Continent in 1908, was conceived by an Italian and executed by a Frenchman. The propelling mechanism consists of a 50 H. P. engine driving a three-bladed propeller, of 20 in. diameter, at 1,200 revolutions, and an air puller, 55 in. diameter, at 600 revolutions. The hull of the boat consists of two layers of 3/16 cedar planking between which a layer of canvas set in white lead is sandwiched.

Although the engine display did not include some of the very large heavy duty types of last year there was a decidedly greater variety, the exhibits ranging all the way from a tiny 1½ H. P. to a 190 H. P. engine. One 150-H. P. engine exhibited proved to be an exceptional attraction owing, no doubt, to the combined lightness and strength of the construction. With few exceptions the engine builders were out strictly to make sales, some concerns having a wide range of engines to suit the pockets of the prospective buyer. Others, again, were satisfied with placing the finest and largest products of their shops on view, a few prize cups sprinkled here and there throughout the Garden speaking more eloquently than words could of the merits of their holder's output.

There can be little doubt that considerable time and care was taken in fitting up attractive booths by the exhibitors of motor boat accessories. There can be little doubt, also, that the courtesy and patience of the attendants

in the booths will reap their harvest if not in the immediate future at least during the coming motor boat season. Judging from the crowds that continually thronged the gallery it would appear that the accessories exhibits were even more interesting than the exhibits of boats to the boat owners.

Another proof of the importance of this comparatively young industry was the occupying of at least six of the booths by healthy-looking magazines devoted exclusively to the building and handling of the motor propelled boat.

DEFEAT OF OCEAN MAIL BILL.

The Ocean Mail Bill came within two votes of passing in the house of representatives on March 2. It had passed the senate on March 20, last. Its defeat was due to the bitter hostility displayed by Congressman T. E. Burton, who, notwithstanding the declaration of his party platform, the protests of his constituents and the rest of the Ohio delegation, led the defection against it.

The bill was one of the most modest and sensible measures ever offered in congress for the rehabilitation of the merchant marine. It merely extended the provisions of the Ocean Mail Act of 1891 to South American ports and did not contemplate the expenditure of a single penny over the present earnings from sea postage. Mr. Burton's opposition to this measure is not readily understood and his views are certainly not representative of the district which he is supposed to represent in congress.

The majority report of the the Committee on Post Offices and Post Roads was a convincing document. After discussing the features of the bill the committee says that it is not only in line with the policy which for some years has been followed by Great Britain, Germany, France, Italy and Japan, but is also in accord with the policy more or less regularly pursued by the United States for more than half a century and on a limited scale followed uninterruptedly for the past 17 years. It is impossible to see how anyone familiar with its features could be opposed to it. To begin with any contract made under the pending bill must be subject to the rigid require-

ments of the Act of 1891. The postmaster general is authorized but not directed to make such contracts. If made, they must, in his judgment, best subserve and promote the postal and commercial interests of the United States. The mail service proposed must be equitably distributed among the Atlantic, Mexican Gulf and Pacific ports. The contracts are to be not less than five years nor more than ten years in duration. They must be made with the lowest responsible bidder and the postmaster general has a right to reject all bids not in his opinion reasonable for obtaining the purposes named.

At the present time there are no American vessels available for adequate postal and commercial service to South America; nor could any such vessels be built under 15 months. Accordingly no expenditure under this head was contemplated until July 1, 1910. The steamships must be built in the United States at an approximate cost of \$1,250,000. An adequate fortnightly service to Rio de Janeiro would involve on the part of the contractors an expenditure of \$5,000,000. During the first two years of the contract at least one-fourth of the crew must be American citizens; during the next three years one-third and during the remaining period of the contract, should it cover ten years, at least one-half. At least one American born boy must be carried as cadet or apprentice for each 1,000 gross tons register.

The steamships must be built with particular reference to prompt and economic conversion into auxiliary and naval cruisers, according to plans agreed upon between the owners and the secretary of the navy. They must be able to carry at least four 6-in. rifled guns and they cannot be accepted by the postmaster general until they have been approved by the secretary of the navy. Any irregularities in the performance of the mail contract will be met with suitable fines imposed by the post office department. The steamships may be taken and used by the United States as transports and cruisers at any time upon appraisal. This bill is in strict harmony with the recommendation of former President Roosevelt and President Taft.

Lake Shipyard Methods of Steel Ship Construction

BY ROBERT CURR.

Fig. 43 shows the expanded outside plating, and the number of rivets to be sheared if the vessel were pulled apart.

The first strake, A or keel plate, shows the keel bars connecting the keel plate to the center keelson.

KBBS is the butt of starboard angle and KBBP the butt of the port angle.

The frames are numbered 1, 2, 3,

4, 5, 6, 7, 8, 9, 10 and 11. No. 6 is the web frame which will be observed is the weakest section of the vessel.

B strake, which is next to the keel plate, shows the girder plate A on same.

The marks AGB is the butt of the plate of girder A.

The 3d strake, C, shows B girder butt BGB.

The 4th strake, D, shows C girder butt CGB.

The 5th strake, E, shows the butt of D girder DGB.

The 6th strake, G, shows the bilge stringer butt BSB.

The 7th strake, H, shows the butt of No. 1 side stringer 1SSB.

The 8th strake, J, shows the butt of No. 2 side stringer 2SSB.

The 9th strake, K, shows the butt of the top of the side tank STTB.

The 10th strake, L, shows butt of No. 3 side stringer 3SSB.

The 11th strake, M, shows seam strap butting between frames No. 10 and No. 11.

Spar deck stringer plate butt SDSB is shown between frames No. 5 and No. 6 and stringer bar butt SDSBB on frame No. 11.

Ninety-seven 1-in. diameter rivets must be sheared through the keel plate to relieve it.

Keel strake 97.

B strake has a resistance of 132 rivets $\frac{7}{8}$ in. diameter.

C strake has a resistance of 107 rivets $\frac{7}{8}$ in. diameter.

D strake has a resistance of 11 rivets $\frac{7}{8}$ in. diameter.

E strake has a resistance of 54 rivets $\frac{7}{8}$ in. diameter.

G strake has a resistance of 200 rivets 1 in. diameter.

H strake has a resistance of 98 rivets $\frac{7}{8}$ in. diameter.

J strake has a resistance of 54 rivets $\frac{7}{8}$ in. diameter.

K strake has a resistance of 202 rivets $\frac{7}{8}$ in. diameter.

K strake has a resistance of 52 rivets 1 in. diameter.

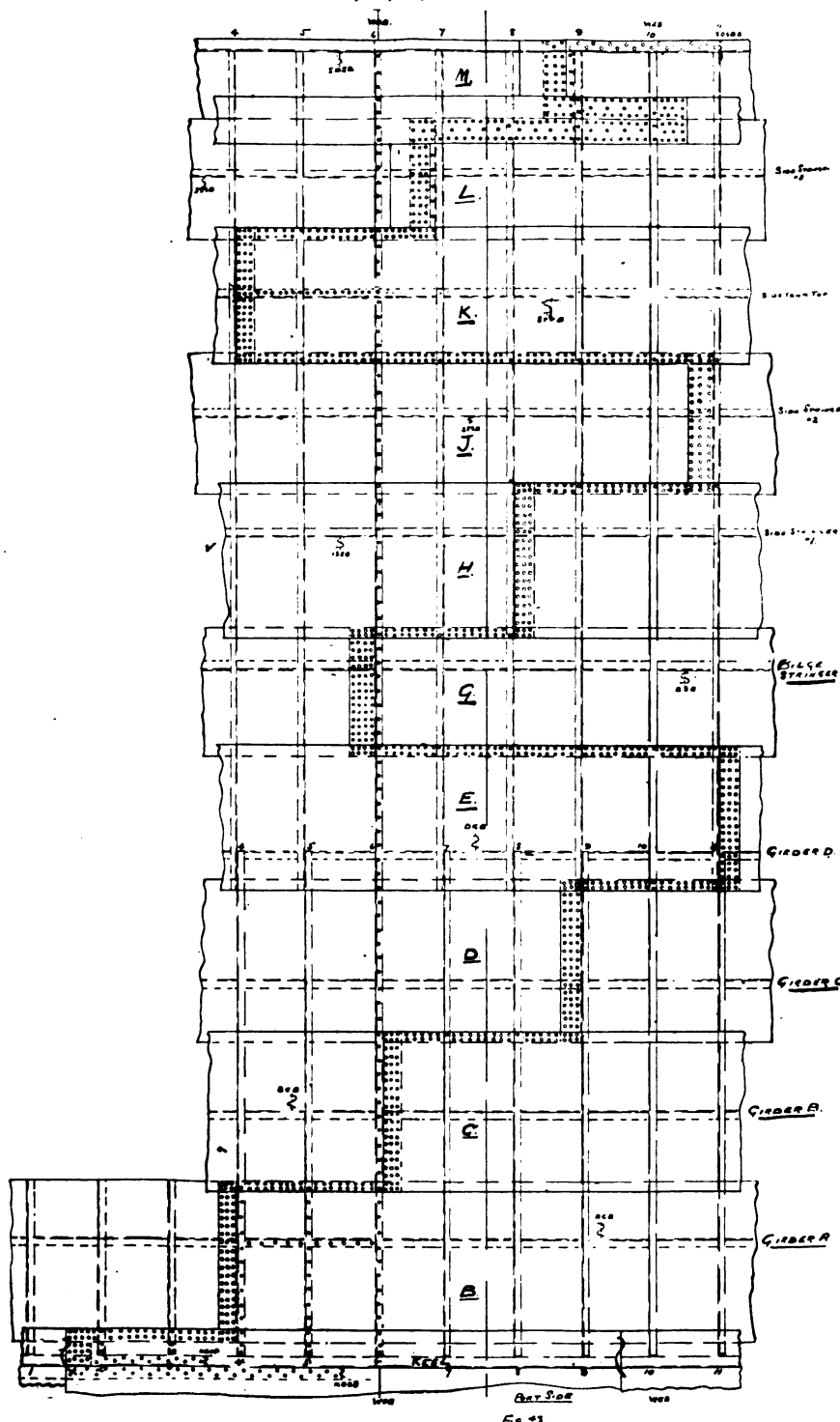
L strake has a resistance of 129 rivets 1 in. diameter.

M strake has a resistance of 86 rivets 1 in. diameter.

The total strength of the 564 1-in. diameter rivets multiplied by 20.4 equals 11,505.6 tons, and 758 $\frac{7}{8}$ -in. diameter rivets multiplied by 15 equals 11,370 tons. 11,505.6 plus 11,370 equals 22,875.6 tons. 22,875.6 multiplied by 2 for both sides of vessel would equal 45,751.2.

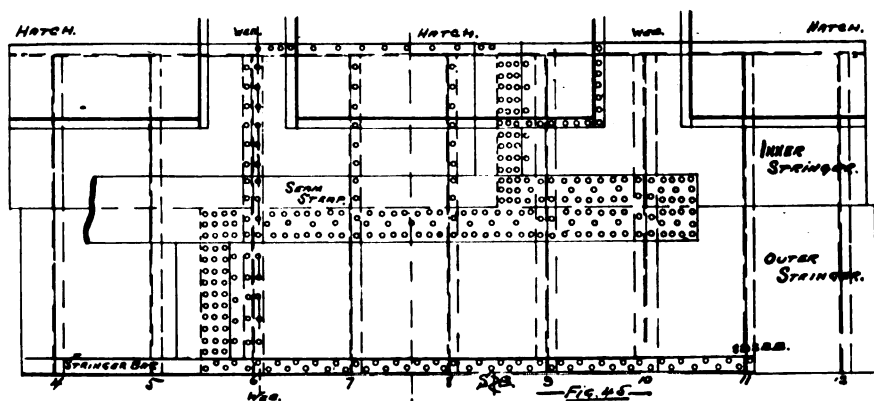
In the last article the material is as follows:

	Square Inches.
Keel plate	15.55
Keel plate angle	4.62
B strake	48.00
C strake	44.00



23,959.00

A stroke 83 rivets $\frac{3}{4}$ -in. diameter
 $83 \times 12 = 996$ tons.



B strake keelson 84 rivets $\frac{3}{4}$ -in. diameter, $84 \times 12 = 1,008$ tons.

C strake keelson 38 rivets $\frac{3}{4}$ -in. diameter, $38 \times 12 = 456$ tons.

D strake keelson 144 rivets $\frac{3}{4}$ -in. diameter, $144 \times 12 = 1,728$ tons.

E strake keelson 174 rivets $\frac{3}{4}$ -in. diameter, $174 \times 12 = 2,088$ tons.

F strake keelson 40 rivets $\frac{3}{4}$ -in. diameter, $40 \times 12 = 480$ tons.

G strake keelson 120 rivets $\frac{3}{4}$ -in. diameter, $120 \times 12 = 1,440$ tons.

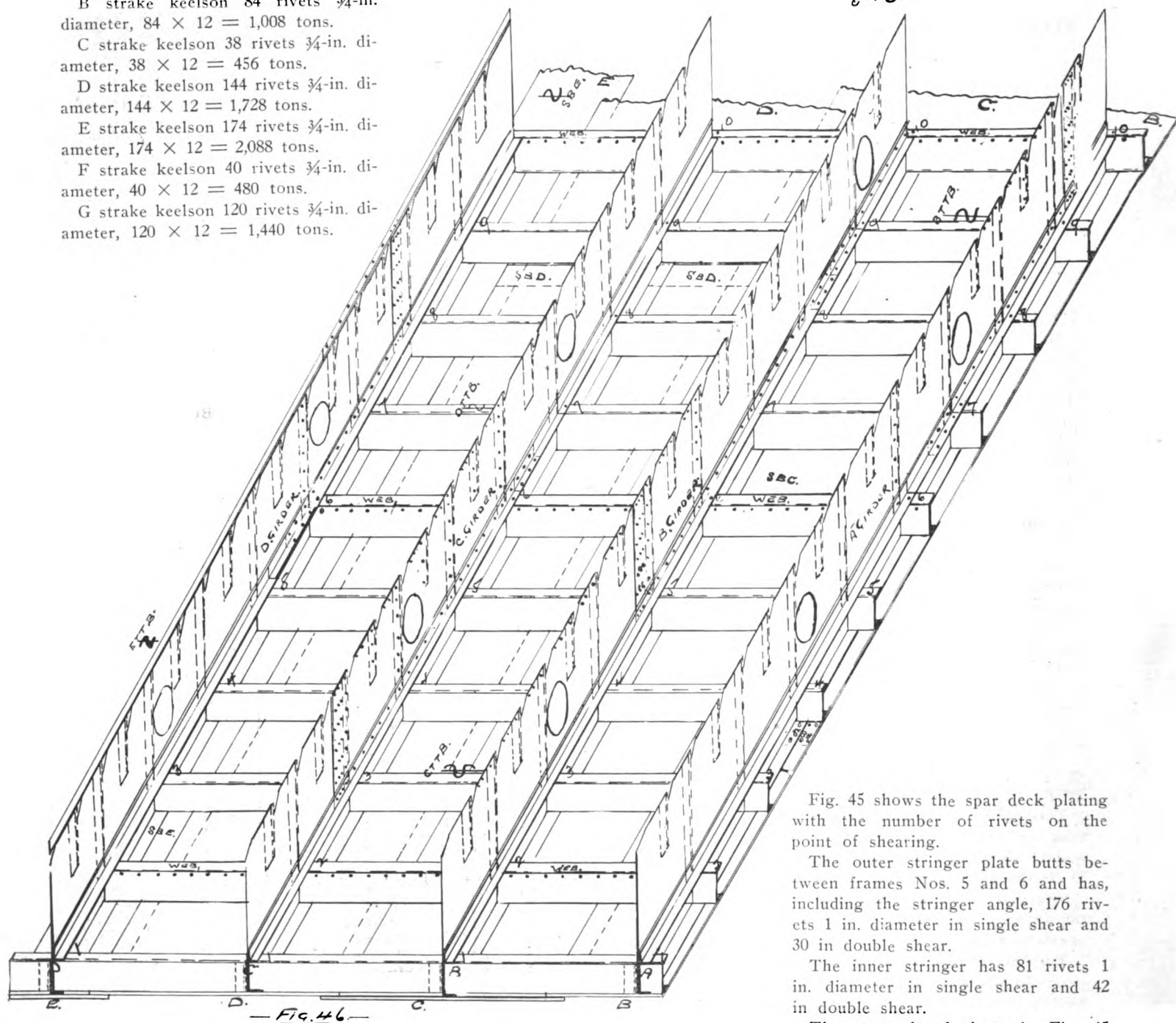


Fig. 45 shows the spar deck plating with the number of rivets on the point of shearing.

The outer stringer plate butts between frames Nos. 5 and 6 and has, including the stringer angle, 176 rivets 1 in. diameter in single shear and 30 in double shear.

The inner stringer has 81 rivets 1 in. diameter in single shear and 42 in double shear.

The strength of rivets in Fig. 45 amounts to 257×20.4 plus 72×36 equals 7,834.8 tons for one side of vessel. $7,834.8 \times 2$ equals 15,669.6 tons.

The area of section of punched materials equals:

Outer stringer 49.80
Outer stringer angle 8.52
Inner stringer 51.00
Seam strap 19.50
Hatch coaming 6.50

135.32
26

3,518.32
2

Total area 7,036.64

Tank side top 121 rivets $\frac{7}{8}$ -in. diameter, $121 \times 15 = 1,815$ tons.

Total, 11,780 tons.

Add for other side, 9,631 tons.

Grand total, 21,411 tons.

In the last article the amount of punched material through the web, frame No. 6 is as follows:

	Square inches.
Center keelson plate	14.09
Center keelson top angle	1.80
A strake	15.00
B strake	29.50
C strake	30.00
D strake	30.00
E strake	29.75

F strake	27.00
G strake	13.87
Tank side top	30.00
Tank side inner angle	3.75
Tank side water tight collar....	1.96

226.72

.26

5,894.72

2

11,789.44

The total strength of rivets over material on the inside plating including center keelson equals 214.11—
11,789.44 equals 9,621.56 tons.

Strength of rivets over area of section equals $15,669.6 - 7,036.64$ equals 8,632.96 tons for this plan.

Fig. 45 shows the butt of sheer strake SB, butt of stringer angle SDSBB, outer stringer, seam strap, inner stringer, hatch opening, hatch coamings and webs.

Fig. 46 shows the arrangement of girders in bottom.

The butts of girder plates and angles are shown with the same marks as before applied to Figs. 43 and 44.

D girder shows the top angle with the horizontal flange cut off.

The web frames are built intercostally on a channel floor which is not usual on the lakes.

In the four (4) girders there are 300 rivets on the point of shearing on each side of the vessel making a total of 600 rivets $\frac{3}{4}$ -in diameter and equal to 12 tons per rivet. 600×12 equals 7,200.

Material in girders amounts to 119.78 square inches. 119.78×26 equals 3,114.28 tons.

The rivets exceed the plates and angles by $7,200 - 3,114.28$ equals 4,085.72 tons.

The shell butts are marked on Fig. 46 similar to other sketches SB, B, SBC, SBD and SBE the shell butts of strakes B, C, D and E.

It is necessary to have access throughout the bottom of the vessel and in cutting holes large enough for a man to pass through, care must be taken not to decrease the area of section of the vessel in any way.

On Fig. 46, manholes are so arranged as to give access throughout the bottom and at the same time retain the strength of the girder plate.

Example: 7 holes are punched for the girder stiffeners, thus reducing the area of the plate by $13/16 \times 7$ equals 5.7 inches. The girder plate is notched out for the intermediate and tank top stiffeners which is 4 inches deep, so that the punching of the rivet holes for girder and tank top stiffeners reduces the girder plate 10 inches.

4×10 -in. equals 40 inches.

This will show that two manholes 20 inches deep may be cut in two girders in the same line across one side of the ship without in any way damaging or reducing the strength of the vessel. Care must be taken to have these manholes clear of butts of adjoining strakes of plating.

The total strength of the rivets on the point of shearing amounts to 66,707 tons. The total area of section of punched materials amounts

to 47,491 tons. The total strength of the unpunched material amounts to 59,970 tons.

The rivets exceeds the unpunched material by 7,000 tons.

The connection of intercostals to the floors and frames have not been considered in this calculation.

The riveting in side stringers may be considered the same as the material which is all that is necessary.

The value of the rivets depends upon the shift of butts and arrangement in butt laps and straps.

NEW STEAMSHIP COMPANY FOR ALASKA BUSINESS.

MacKenzie Bros., Ltd., of Vancouver, B. C., have chartered the American steamer Leelanaw and the barges John C. Potter, Two Brothers and Oregon, which they announce are to be the nucleus of a new fleet of vessels to be operated during the coming summer between Seattle and southeastern Alaska ports, the ports of call extending as far north as Nome. Capt. S. F. MacKenzie, manager of MacKenzie Bros., has recently been in Seattle and made final arrangements for operating the new line with Seattle as the southern terminus. A contract has been made with the Arlington Dock Co. and the MacKenzie vessels will berth at piers 4, 5 and 6. The agreement goes into effect April 1, after which date the Leelanaw will commence running regularly to Skagway and Valdez, Alaska, via ports. When the Nome season opens the company will dispatch the Leelanaw to Norton sound. Being equipped with steam towing gear the Leelanaw will be able to handle barges without difficulty. The barges will be used for transporting lumber, coal and rough cargo in addition to general merchandise on the outward trips. Returning they will freight copper, ore and other raw material from the north. MacKenzie Bros., Ltd., have just closed a contract with the Sulzer mines, Prince of Wales island, for freighting 6,000 tons of copper ore per month to the Tyee smelter at Ladysmith, B. C. This contract runs two years.

The steamship Leelanaw is a steel vessel of 1,923 gross and 1,377 net tons register, built in 1886. She is 274 ft. in length and 36 ft. beam. She has one triple-expansion engine 22, 35 and 58 in. in diameter by 42 in. stroke; the boilers carry 154 lbs. per sq. in. pressure. The steamer has freight and passenger accommodations. In the near future she will go into the dry dock at Esquimalt, where she will be thoroughly overhauled and equipped. About \$25,000 will be expended in repairing the

vessel. She will be fitted with additional passenger accommodations.

The Norwegian steamer Transit will form a part of the new line and will be dispatched from Seattle for Nome not prior to June 5.

Capt. MacKenzie, in an interview, said in part: "Prospects for business in Alaska never looked better than at present and I anticipate one of the busiest years since the northern trade developed. There is a large amount of business in sight on the Skagway run and I expect our tonnage to be filled to the limit. We have never entered into a combination and our line will be operated strictly independent of all other concerns."

RIVER AND HARBOR BILL.

The emergency river and harbor bill carrying an appropriation of \$8,185,750. The general purpose of the measure is to provide against delay of existing contract work. The bill also contains provisions for a settlement of the controversy existing over the ownership in fee simple absolute by in order that the interests of navigation may be defended at that point. The bill therefore declares that the ownership is fee simple absolute by the United States of all lands north of the present ship canal throughout its entire length and extending to the international boundary line is necessary for the purposes of navigation. The secretary of war is directed to take immediate steps to acquire the land by condemnation proceedings or otherwise and the circuit court for the western district of Michigan is given exclusive jurisdiction to hear condemnation proceedings and to determine what compensation should be awarded. Every permit and license granted to any private company is to cease after Jan. 1, 1911.

The secretary of war in his discretion may permit the Chandler-Dunbar Co. and the Edison-Sault Electric Co. to maintain their present works and to utilize the water power in the rapids in so far as the same does not interfere with navigation, but such permits shall not extend beyond Jan. 1, 1911.

The secretary of war is authorized and instructed to make a preliminary examination and survey for the construction in the rapids of a filling basin or forebay from which the ship locks may be filled.

THORNYCROFT PARAFFINE MOTORS FOR THE ROYAL ITALIAN NAVY.

These engines, which are to be installed in two twin-screw submarine boats, are constructed in four-cylinder units, bolted together, making eight cylinders on each shaft. The dimensions of the cylinders are 12 in. diameter by 8 in. stroke.

They are totally enclosed and lubrication is forced to all bearings; those on the crankshaft, and also the bottom of the crankcase, being watercooled.

In addition to this, the pistons and crankcase generally are continuously cooled by sucking cold air which is drawn through by an exhausting fan.

Facilities are provided for the removal and replacement of the pistons and connecting rods through the doors in front of the engine, thus rendering removal of the cylinders and access from the back of the motor unnecessary; an ad-

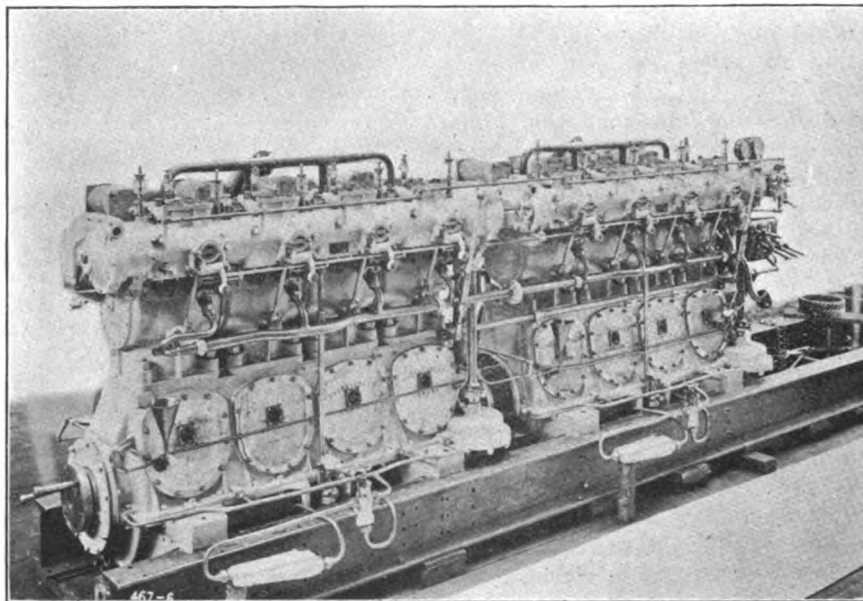


FIG. 1—THORNYCROFT PARAFFINE MOTORS FOR THE ITALIAN NAVY. GENERAL VIEW OF EIGHT-CYLINDER, 350 H. P. MARINE SET.

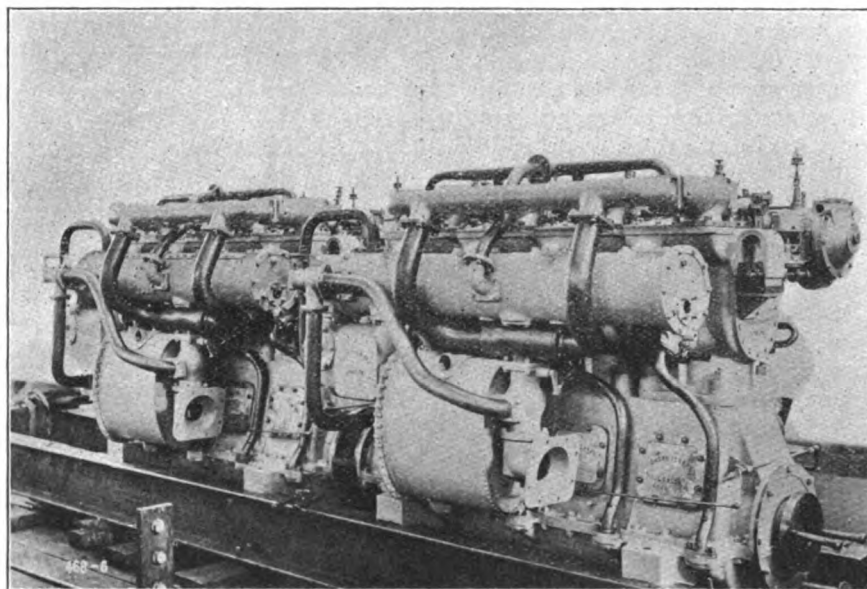


FIG. 2—THORNYCROFT PARAFFINE ENGINE FOR THE ITALIAN NAVY. ANOTHER VIEW OF ONE OF THE EIGHT-CYLINDER SETS.

vantageous feature for submarine boats.

Cooling water is circulated by a separately driven centrifugal pump, driven by either an electric motor, or a small oil motor using the same fuel as the main engine. A great advantage of this method is that the motor may be cooled more rapidly after running, in case examination or adjustment becomes necessary. The separate drive also allows of a close regulation of the quantity of water to suit the needs of the engine, according to the nature of the fuel used.

The special paraffine vaporizer is fitted with a variable exhaust by-pass so that the temperature may be exactly graduated to the needs of the particular fuel

used. This is very essential, as the oils used for fuel vary so greatly in the amount of heat required to vaporize them, and excess of heat is as harmful as too little. With a proper regulation of the heat the engine or vaporizer never requires to be cleaned as there is no tar deposit. Trouble on this score is absolutely non-existent with these engines.

An entirely novel feature is the reversing mechanism. Instead of the usual method of using a double set of cams for running in either direction, the camshaft is so arranged that, whichever direction the engine itself runs, the camshaft turns in one direction only, and to provide for this a reversible bevel drive, with positive clutches, is fitted.

Starting in either direction is effected by means of compressed air, the valves controlling which are cut off immediately the engine is firing.

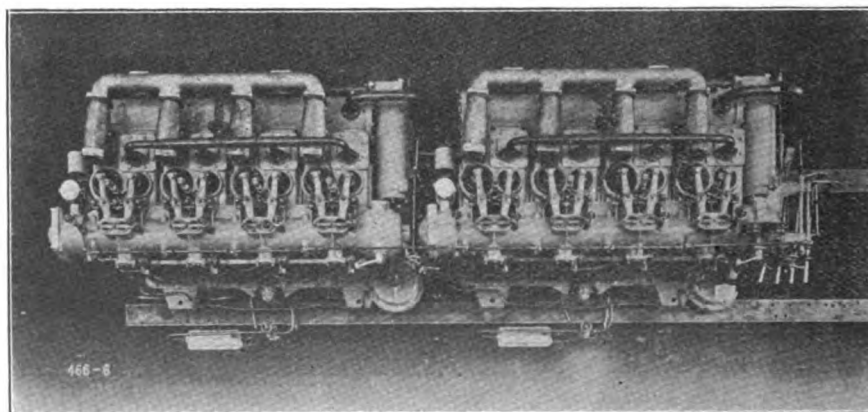


FIG. 3—VIEW TAKEN FROM ABOVE ONE OF THE EIGHT-CYLINDER SETS.

Low-tension magneto ignition, and distributor, are fitted in connection with a special form of make and break gear in the cylinders.

The consumption of fuel is very low, being about 0.7 pint of paraffine or petrol per brake horsepower per hour.

The engines are designed with ample bearing surfaces, and are in every way suitable for heavy continuous service.

The total weight per four-cylinder set is 70 cwts.

The following table of results of a three-hours' trial is of interest:

TRIAL OF F4/1 & 2, 8-CYLINDER 12" DIA. X 8" STROKE, REVERSING.

Fuel used.	Phoebus Paraffine S. G. 0.820.	
Consumption	0.66 pint per B.H.P. per hour.	
Time from start.	B.H.P.	Revs.
hours.		
0	324	550
½	328	555
1	340	590
1½	327	595
2	318	595
2½	318	600
3	324	600
Average revs. per minute, 582.5.		
Average power, 325.5 B. H. P.		

SIAMESE REVENUE CRUISER AND TENDER.

Messrs. J. I. Thornycroft & Co., Ltd., of Southampton, England, have just completed the building of a Siamese revenue cruiser, named "Suriya Monthon." This vessel is of a type which is likely to become very useful where smuggling is rife. She is the second of her type built by Messrs Thornycroft, the first being the "Amapa" for the Brazilian government.

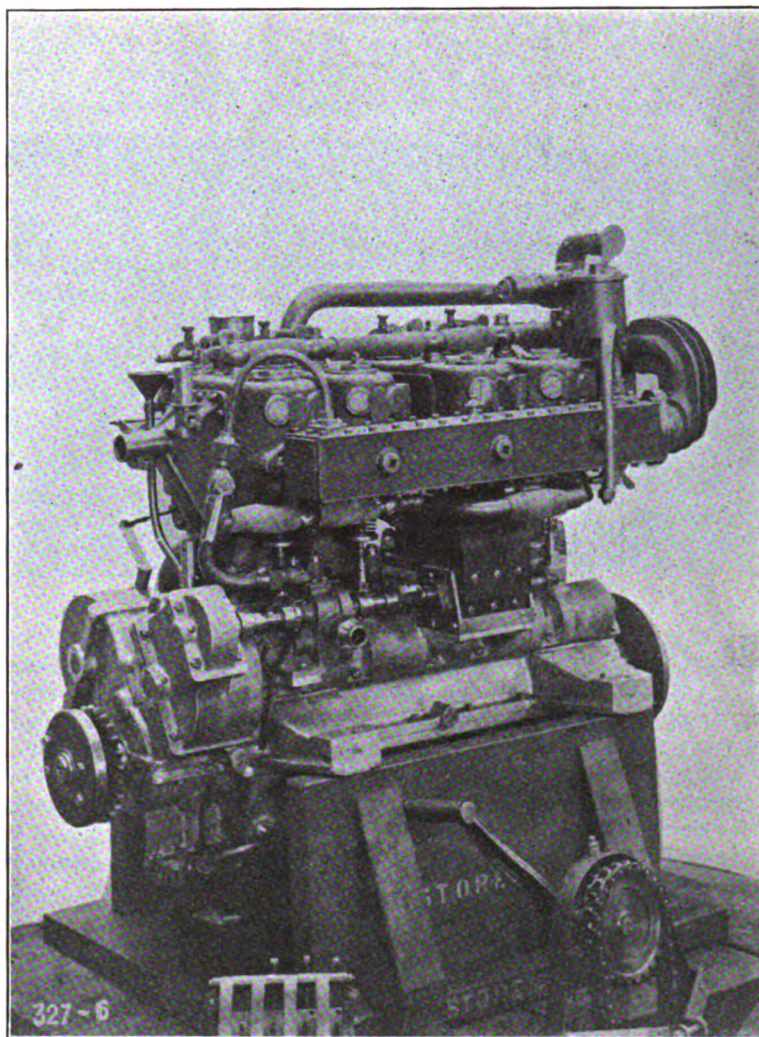
The particular duties of the "Suriya Monthon" will be the suppression of the existing practice of opium and fire arms smuggling which is carried on to a very great extent in Siam. In addition to this she will prove a very handy and fast dispatch-boat, and her seaworthi-

ness is vouched for by the fact that the sister vessel "Amapa" crossed the Atlantic to Buenos Ayres under her own

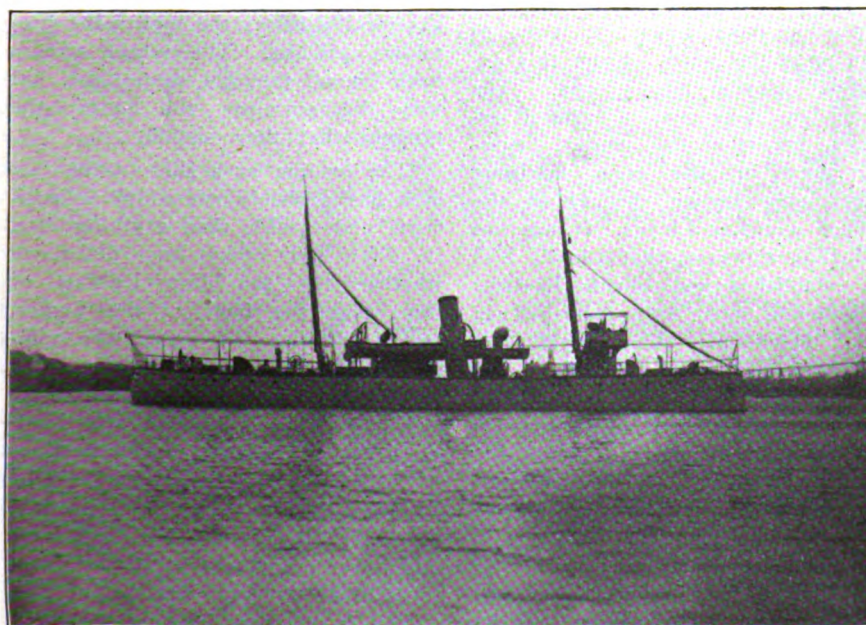
power, and without any discomfort to the crew. The vessel which is here illustrated is 137 ft. long over all, 135 ft. on water line, and 130 ft. between perpendiculars, by 18 ft. beam, 9 ft. 1 in. in depth, molded, with a draught of 6 ft. and carries on her forecastle a 6-pounder Hotchkiss quick firing gun.

The hull is of Siemens-Martin bullet-proof steel, and has 14 water tight bulkheads, one only of which is fitted with a watertight door, the others being intact. The forward and aft decks are also watertight. These precautions against foundering are rendered very necessary by the numerous uncharted coral reefs abounding in the seas in which she will cruise.

The machinery comprises two sets of three-cylinder surface condensing engines with cylinders 9 in., 13 in. and 20½ ins. in diameter respectively, by 11 in. stroke, and a Thornycroft water-tube boiler of 210 lbs. working pressure, working under forced draft. The speed is 14½ knots, with a load of 40 tons, and 700 indicated horsepower. Two condensers having separate circu-



MOTOR FITTED TO TENDER OF SURIYA MONTHON.



SIAMESE REVENUE CRUISER SURIYA MONTHON.



MOTOR TENDER OF SURIYA MONTHON.

lating pumps, a Caird and Rayner evaporator capable of supplying $2\frac{1}{2}$ tons of fresh water per 24 hrs., a drinking-water distiller, and three steam-pumps for feed, bilge, and fire purposes respectively are provided. The vessel is electrically lighted throughout all compartments, and a search-light projector of 10,000 candle-power is placed on the bridge.

In addition to the ordinary ship's lifeboats and dinghy, a motor tender will be carried. This is a standard type

Thornycroft launch, 30 ft. long, built of teak throughout, and provided with the necessary cork belting, air tanks, etc., to pass the Board of Trade requirements for a lifeboat. The motor is the popular Thornycroft four-cylinder $4\frac{1}{2}$ in. x 5 in. type, developing from 23 to 26 brake horsepower; using paraffine as fuel. The speed of the launch is 12 miles an hour.

The contract speed for the cruiser of $14\frac{1}{2}$ knots was easily exceeded by more than $\frac{1}{4}$ knot on the official trials.

Harvey D. Goulder Addresses Vessel Masters.

Mr. Harvey D. Goulder, counsel for the Lake Carriers' Association, addressed the Cleveland lodge of the Ship Masters' Association on Friday last on the subject "Some Things We Ought to Know." Naturally the new insurance plan of the vessel owners occupied his chief attention. It must be said that he covered the subject thoroughly. In fact, thoroughness is one of Mr. Goulder's distinguishing traits, and it was therefore natural that he should have gone back to the earliest records of insurance.

Marine insurance was known to the Lombards as early as the twelfth century. The first reported law suit involving marine insurance was filed in 1589 and in 1601 a special court was established for the trial of marine insurance cases. In 1688 the first mention of Lloyds Coffee House occurred. This Coffee House, as is well known, was the popular resort of merchants and underwriters who

interchanged ideas and views. Out of this interchange grew the practice of posting more important items of news upon the walls. From this developed Lloyds Ship News. The sharing of risks was a natural sequence, and from this modest beginning grew up the great maritime society now known throughout the civilized world as Lloyds. It was not until 1726, however, that Lloyds List was established and Lloyds Register of Shipping was first published in 1730. Meanwhile, the Royal Exchange Assurance Corporation and the London Assurance Corporation had been incorporated by charter in 1720, with the privilege of being the only corporations or societies who were allowed to insure marine risks or lend money on bottomry.

Mr. Goulder discussed very lucidly the rules that had been formulated by the advisory committee for the safe navigation of vessels under the

general plan of inter-insurance. He said that vessel owners had passed through a hard season and were about to start upon another. He admitted that there were too many ships for the business now offering, but hoped that conditions would improve by next year. The depression has brought about a changed condition with the necessity of great economy. No one desired to reduce wages, and therefore the saving must come from other directions. Both owner and master must appreciate that the relation between them is one of interdependence. Nothing good or ill can happen one that does not affect the other. Continuing he said:

"It is silly to think that the inter-insurance plan which has been adopted by the vessel owners is directed against any one. It is all for the betterment of things all along the line. It requires the co-operation of all parties interested. Our ships have grown rapidly and we have not been able to keep up improvements. Insurance rates on the lakes have advanced 40 per cent. in a short time and we are not only confronted with a rate of 5 per cent. but a further advance. The premiums have not been great, in fact they have not been big enough to take care of the losses and that means that something is wrong. The masters ought to know that no one is blaming the captains or owners in any specific way but what is needed is a system.

"Accidents to ships are common to everybody on the lakes and the losses fall equally on all the owners that insure their boats. The insurance people do not pay the losses. The boat owners settle in premiums and the greater the losses the higher the premiums will be. The vessel owners have known that for some time, but they did not give the matter the thought that they should.

"The loading of a ship to the last inch has probably caused more accidents and trouble than anything else. It does not make any difference whether the too deep loading of ships was the fault of the owner, dock foreman or the master the committee in charge of the insurance plan has decided to put a stop to the practice. The rules will fix a safe loading depth and when a master declines to load his vessel deeper he will be protected by the association. When an owner tolerates the loading of his ship lower than the depth decided on, he will soon learn that he is not wanted in the association.

"The government rules are the only

rules we have for the operation of our ships but the advisory committee has made some suggestions which if followed, will prove to be a benefit to all. In all cases where an anchor is lost mark the spot as near as possible and give immediate notice to the officers of the association. The committee has decided to see what can be done to encourage the use of the whistle in fog, passing ships and notification of danger. If we are in doubt say so. Men aboard the ship should remain in their position at all times when on watch.

"The inter-insurance plan was adopted for the purpose of making navigation safer and it can be put into effect by the co-operation of the vessel owners and masters and the assistance of the underwriters. Remove the unnecessary losses and if we can reduce the insurance rate from 5 per cent. to 4 per cent. we can save a million dollars of expense. A reduction to 3½ per cent. which is as low a rate as we can expect to get, would mean a saving of \$1,500,000. That is our aim. That is all there is to the inter-insurance plan and we hope and believe that through the effects of the owners and masters it will be brought about."

A number of vessel owners attended the meeting, including H. Coulby, A. W. Hawgood, Capt. John Mitchell and Howard Shaw.

PACIFIC COAST NOTES.

Office of the MARINE REVIEW,
302 Pioneer Bldg., Seattle, Wash., Feb. 27.
The Pacific Coast Steamship Co. has commenced fitting out its Alaska fleet in preparation for the coming season. During the winter the vessels have been laying up in the Duwamish river at South Seattle and at Eagle Harbor. The steamer City of Seattle is being fitted out for the Skagway run by The Moran Co. Her engines have been taken out and thoroughly overhauled, the piping has been refitted, and all necessary minor repairs required by the machinery have been made. The vessel will be ready for service about Mar. 15. The freight steamer Tampico has also been thoroughly overhauled during the past month, particular attention being paid to her boilers. Bids have been received for the repair of the Pacific Coast Steamship Co.'s steamer Al-Ki, but the contract for the work has not yet been let. The repairs will cost about \$15,000.

The steamships Yucatan, Victoria and Santa Clara of the Alaska Steamship Co.'s fleet are now undergoing their annual overhauling at Seattle ship yards. The Dolphin has not yet been over-

hauled but tenders for the work will be received shortly.

The steamship Humboldt will sail from Seattle for Skagway Mar. 6. For several years the Humboldt has been operating on the southeastern Alaska route as an independent liner under an agreement with the Pacific Coast Steamship Co. This agreement terminated Jan. 1. The announcement of the Mar. 6 sailing indicates that the owners of the Humboldt will continue to operate the steamer on the old run in competition with the liners of the Pacific Coast and Alaska Steamship companies. Some hot competition is expected.

The tug Blanche owned by the Crosby Towboat Co., ran aground and capsized near the plant of the Seattle Lumber Co., Seattle, Feb. 22. She lay on the beach all day but was finally raised and towed away for repairs. The damage to the vessel is not serious.

The Standard Oil Co.'s tank steamer Con. E. L. Drake, bound from Point Richmond to Seattle, lost two blades from her propeller while off Cape Blanco. The vessel is proceeding and will be repaired on reaching Puget Sound.

The sailing schooner Lottie was wrecked recently in Baranoff harbor, near Unga, during a severe storm and is a total loss. Four of her crew were rescued. The report of the wreck was brought to San Francisco by the schooner John D. Spreckels.

Extensive repairs to the U. S. Cruiser Milwaukee which have been in progress at the navy yard, Puget Sound, for six months are nearing completion. Besides having a new fire control system installed the vessel has undergone a very thorough overhauling. It is stated that the Milwaukee will leave for a cruise to Honolulu March 15 and that she will return to Portland, Ore., in June to be present at the annual Rose Carnival.

A movement has been started to have the state of Washington appropriate \$100,000 for the improvement of the upper Columbia river between Brewster, Bridgeport and Kettle Falls, Wash. The movement is fathered by Capt. Fred McDremott, of Kettle Falls, a well known river pilot. A bill covering the appropriation has been introduced by Representatives Hall and Bolinger and the measure is now before the appropriations committee. The prospect for its passage is favorable. The legisla-

ture of 1907 appropriated \$125,000 for the improvement of the upper Columbia and Snake rivers in Washington and the money has been expended by the United States army engineers in conjunction with the federal government appropriation. All of the money was expended below Wenatchee. It is now proposed to extend operations further up the Columbia. These improvements would make possible the operation of quite a fleet of light river steamers on portions of the river now not navigable.

Local steamboat inspectors, Bion B. Whitney and Robert A. Turner have suspended the master's certificate of Capt. F. E. Wyman of the steamer Vashonian for 15 days. The decision is the result of an investigation of a collision between the Vashonian and the Defiance at the wharf at Vashon Island two weeks ago. The Vashonian backed into the Defiance and while the damage was small and no one was injured, the accident was evidently due to carelessness. Capt. J. C. McDowell of the Defiance was exonerated by the inspectors. Rivalry for business between the Defiance and the Vashonian is very keen.

The bill which has been introduced at the present session of the Washington state legislature, providing for the establishment of port districts and incorporated port commissions by the tide-water cities of the state will not be withdrawn from the legislature but will be allowed to lay over until the next session, when it will be taken up.

D. McKenzie, general agent for the Pacific Coast Steamship Co., has resigned, effective March 1, to go into other business. Mr. McKenzie will be succeeded by E. C. Ward of San Francisco. Both Mr. Ward and Mr. McKenzie are widely and favorably known in Pacific coast shipping circles.

The bulk freighter Eugene J. Buffington will be launched at noon on Saturday next, at the Lorain yard of the American Ship Building Co. This freighter is being built for the Pittsburgh Steamship Co. and is a duplicate of the Alva C. Dinkey, launched a few weeks ago. The steamer is named in honor of the president of the Illinois Steel Co. and will be christened by Mrs. Buffington.

The steel drill boat building at the yard of the Empire Ship Building Co., for the Empire Engineering Corporation at Buffalo, was launched on Tuesday afternoon.

Apparatus for Recording the Rolling and Pitching of Ships.

While engaged in determining the gravity constant at sea, Prof. O. Hecker, of Potsdam, an acknowledged authority in this field, was troubled with the difficulty of taking accurate barometric readings with the usual rolling even of a steady ship. The outcome of his experiments has been a very simple apparatus for registering the rolling and pitching of ships, which he describes in a recent issue of the *Zeitschrift für Instrumentenkunde*. The substance given herewith was condensed by *Engineering*, London.

When a barometer is inclined to the vertical by the angle a , the true reading of the barometer will be $B = B_1 \cos a$, where B_1 is the apparent reading. As long as a is measured in minutes, the difference between the true and the apparent readings may be neglected. But for $a = 1$ deg. of arc the difference would already amount to 0.16 millimeter of mercury, and for $a = 2$ deg., to 0.46 millimeter. It is, therefore, necessary to measure the inclination of the ship, so as to make the necessary barometer correction. If a pendulum is suspended on board ship in such a way that it can swing only transversely, the pendulum will be set into oscillation by the rolling of the ship, and its motion will be the result both of the change of inclination and of the horizontal displacement of the point of suspension. The object of Hecker's device, now under notice, is to arrange the pendulum so as to minimize the horizontal displacement. The pendulum will then practically indicate the momentary inclination of the ship, which has to be ascertained. A formula for the amplitude of the oscillation which a pendulum describes under the influence of the horizontal displacement of its point of suspension was communicated by Wiechert to the first International Seismological Conference meeting at Strasberg, in 1902. Applying that formula, Professor Hecker demonstrates that the object stated—the diminution of the horizontal displacement—can be secured in various ways, best by making the ratio of the periods of rolling T_1 to the natural periods of the pendulum T_2 , T_1/T_2 , as large as possible; in other words, by making the period of the pendulum very small. The pendulum should hence be short, but sufficiently heavy, of course, to overcome friction.

Fig. 1 illustrates the apparatus

which Professor Hecker designed for this purpose. There are two pendulums, one for registering the rolling, the other for the pitching. The pendulums are stout, heavy discs, pivoted near their circumference. The length of the corresponding mathematical pendulum can be deduced from the formula:—

$$\left[\int_0^r 2\pi r^3 dr + r^4 \pi \right] / r^3 \pi = \frac{3}{2} r,$$

where r is the radius of the disc. If $r = 2$ centimetres, the length of the mathematical pendulum would be 3 centimetres, and its period 0.18 second. The style attached to the pendulum has a length of 11.4 centimetres, and with these dimensions an inclination of the ship by 0.5 deg. would produce a motion of the style through 1 millimetre. Hecker found that the large ships on which he experimented had rolling periods ranging from about 10 to 30 seconds; we shall revert to this point again, however. According to Wiechert's for-

mula, the just-described apparatus would reduce the horizontal displacement of the point of suspension for the two periods mentioned to 0.0049 or 0.0005 of its true amount. The effect of that horizontal displacement can hence be neglected, provided the pendulum be suitably suspended. The amount of the horizontal displacement is not the same for all parts of the ship; the pendulum should be suspended near the longitudinal axis, about which the ship is oscillating, where the displacement is smallest.

In the actual apparatus the discs are made of brass, 40 millimetres in diameter and 16 millimetres in thickness; the styles, of aluminum, resemble the styles of barographs. The endless paper belt, on which the records are inscribed, is stretched over two cylinders, one of which is turned by clockwork at the rate of 12 millimetres per minute. In the improved form of apparatus which the optical workshops of R. Fuess, of Steglitz, near Berlin, are constructing, the paper is continuous and the motion of the pendulum is damped by a liquid. The upper pendulum records the rolling; its axis is parallel to the longitudinal axis of the ship. The

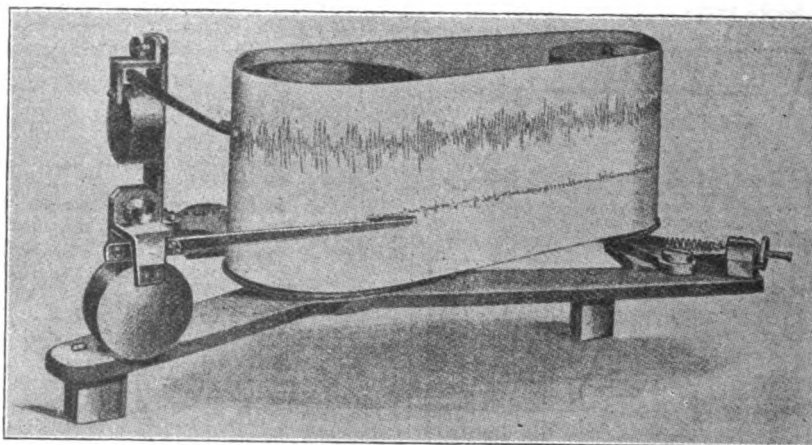


FIG. 1.

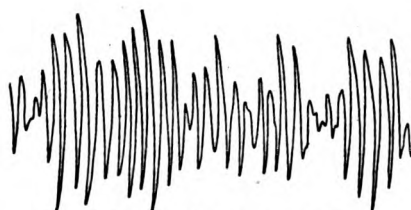


Fig. 2. "SONOMA" 6000 REG. TONS



Fig. 3. "MANCHURIA" 13700 REG. TONS



Fig. 4. "PRINCESS-ALICE" 11000 REG. TONS



Fig. 5. "TANGLIN" 1200 REG. TONS

(1022.8)

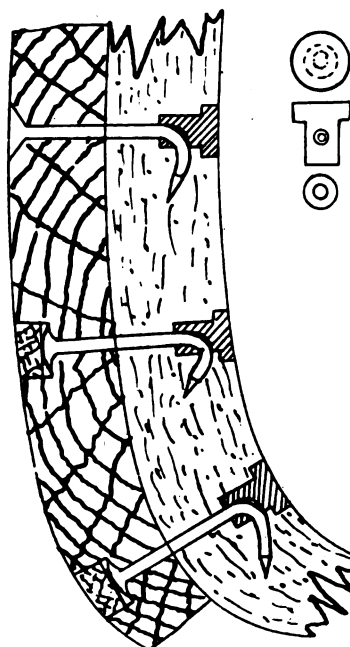
lower pendulum records the pitching; its axis is at right angles to the longitudinal axis of the ship.

Figs. 2 to 5 are reproductions of records obtained on different ships. The various ships differ quite as strongly as to their pitching and rolling as could be expected. The Sonoma, 6,000 register tons, of the Oceanic Steamship Company, was on her way from Australia to New Zealand when the records of Fig. 2 were obtained. The Manchuria (Fig. 3), 13,700 register tons, of the Pacific Mail, was steaming from the Sandwich Islands to Japan. The Prinzess Alice (Fig. 4), 11,000 register tons, of the Norddeutsche Lloyd, was steaming in the Chinese Sea; and the Tanglin (Fig. 5), 1,200 register tons, also of the Norddeutsche Lloyd, was cruising in the Gulf of Siam. It has already been mentioned that a change in the ordinate of 1 millimetre on the diagram corresponds to an inclination of the ship through half a degree of arc; the time scale is marked on the diagrams. The two large steamers, the Manchuria and the Prinzess Alice, show, in addition to the short-period motions, rolling oscillations of more than two minutes. The diagrams are, of course, not directly comparable, as winds and seas differed. But the simple apparatus gives definite information about the smaller oscillations, which had so far hardly been studied quantitatively, and it will be interesting to compare these curves with other stability curves taken on board ship.

THE SCHLOTTMANN NAIL LOCK.

One of the many interesting exhibits at the New York Motor Boat Show was a nail lock invented by Fred. C. A. Schlottmann, Evergreen Ave., Brooklyn, and used in the construction of wooden boats. This lock is an improvement on the present method of riveting or clinching the nail, as it not only makes a secure and durable fastening but improves the appearance of the boat to no little extent. The accompanying illustration is a sectional view of the planking of a hull, the nail locks shown in position.

To apply the nail lock the usual hole is bored, an additional hole to receive the nail lock being bored on the inside of the boat. The nail lock is then driven into the place and held in position by a heavy nail while the nail is being driven home. It will be noticed that the hole in the lock is so designed that the nail turns itself and enters the wood in a hooked position. There are four designs of nail locks to suit the



THE SCHLOTTMANN & BACHENBERG NAIL LOCK.

different requirements of the boat-builder, the sizes ranging from the ordinary 8-penny nail to $\frac{1}{2}$ inch. They are of brass or malleable iron galvanized.

NEW DEVICE FOR SHIP REPAIRS.

A new invention, the Williamson submarine tube-caisson, is intended to supersede drydocks and enable the crew to clean in a fairly thorough manner the foul bottom of a ship in seas where drydocks are not available. It is expected to permit replacing a lost propeller while at sea, or repairing moderate injuries below the water line.

The caisson, which is in operation at Norfolk, has been inspected by several officers of the navy, and their reports are said to be so favorable that the Williamson company is preparing a set of blue-prints for caissons of various sizes equipped in a variety of ways with glass bull's-eyes, stuffing-boxes through which tools can be manipulated, flexible rubber arms, electric lights and other appliances to aid in under-water work.

The caisson is a flexible steel-ribbed tube which, when extended, makes a well in the water. At the bottom is a work-chamber fitted with bull's-eyes and rubber arms. To overcome the greatly increasing pressure of water at increasing depth, Capt. C. Williamson, the inventor, designed a collapsible tube of iron plates working on hinges outward, after the manner of an accordion. A section fully extended is ten feet in height. Put

over the side of the vessel it displaces just as much water as it weighs and remains extended. To the top is clamped another section, the joint being water-tight. As the lower section is slowly forced into deeper and denser water by the weight of the added section it slowly and slightly collapses until its displacement again equals its weight. The addition of other sections has a corresponding effect until the bottom section, at a great depth, is collapsed into a space of less than six feet and is capable of resisting great pressure. It is believed that work can be carried on at a depth of 150 feet. The caisson is enclosed in a canvas rubber-coated jacket impervious to water.

For the navy it is proposed to fit the caissons with solid inserts between each section, each insert to be equipped with bull's-eyes and rubber arms. By lowering the caisson over the side of a vessel and drawing it close to the hull it will be possible for two or three men to work simultaneously in cleaning the hull or making repairs, the rubber arms enabling them to manipulate tools dropped on the outside from above and operated by compressed air. Work has already been done in Norfolk harbor on the wreck of the Rogers in 25 feet of water and the caisson will probably be engaged in repairing the sea-wall at the Norfolk navy yard. Should the government undertake to raise the Maine a proposition will be submitted for furnishing specially designed Williamson caissons for this work.—*Army and Navy Journal*.

THE WORLD'S FASTEST SHIP.

In the course of the trials now in progress, the new torpedo-boat destroyer, "Swift," built as an experimental vessel for the British admiralty by Messrs. Cammell-Laird Co., Birkenhead, has attained the remarkable speed of 38 knots per hour. This is the greatest speed at which a vessel has ever traveled.

The "Swift" has twelve boilers, eight turbines, and four propellers; and burns from 12 to 14 tons of petroleum each hour. The Admiralty will not permit her to be "let out," otherwise her speed could be considerably increased.

New Japanese legislation is expected whereby the subsidies of the Nippon Yusen Kaisha will be reduced by \$270,000 and those of the Toyo Kisen Kaisha by \$75,000. The total amount of the subsidies granted by the new bill is \$3,762,125.

AMERICAN SEMI-PLUG PISTON VALVE.

This valve is called Semi-plug, because while it is without steam it is a snap-ring valve, that is, the packing rings are expansible, and fit themselves to the valve chamber, but when the throttle is opened, the steam is admitted to the chest to enter the space below the rings, and the action of this pressure is to lock the snap rings in a fixed diameter, making practically a plug of it during the time the pressure is on. This is all-important is a piston valve for to secure proper service, it is necessary to maintain true cages in order to maintain steam-tight valves. Steam-tight valves cannot be secured without proper design and construction of rings to begin with, and the absolute regulation of their frictional con-

with the wide ring, number 3, interlocked into each snap ring forms the complete packing.

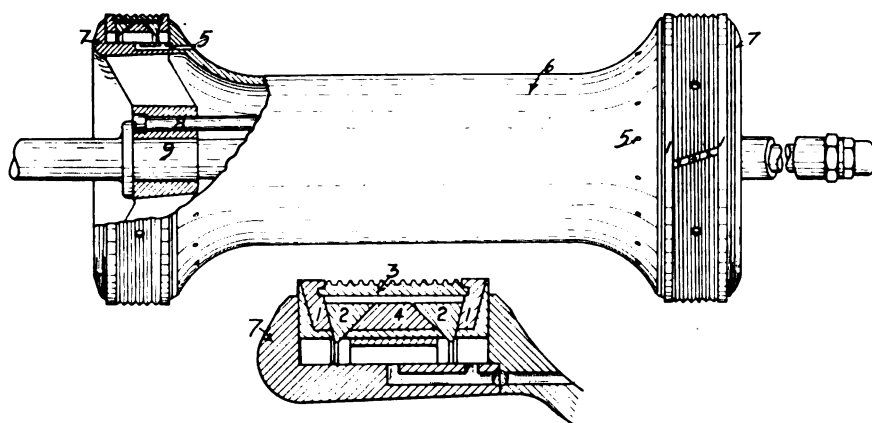
The wide rings perform two important functions: First, it carries the snap rings across ports while drifting, and, second, it keeps the snap rings parallel with each other.

Now, having the principle of the valve fixed clearly in mind, we will note its operation. Wedge ring, No. 4, is put in under tension; its tendency, therefore, is to crowd the two solid wall rings laterally against the cone-sides of the two snap rings, No. 1. This prevents lateral wear of all rings. The degree of angle on the cones, it will be observed, is much greater on the double-tapered wedge ring than on the snap rings. These angles are so calculated that, while the pressure is underneath all the

combination of rings, which are free to move up and down on the spool, that the rings may fit the cage perfectly correct, regardless of any variation in the position of the spool. As it is disastrous to the valve cage to allow the spool to ride on it, as it wears the cage out of true, and, therefore, destroys the perfection of valve service, we make no provisions for carrying the spool on our rings, and the spool must, therefore, be carried on the valve rod. This can be accomplished in any way desired, but is the one feature essential in using this valve.

By observing the locking effect of the double-tapered wedge ring, when it is expanded by presence underneath, thereby crowding the two solid wall rings laterally and holding them, as it were, with a pre-determined force against the cone sides of the snap rings, it will readily be realized that by putting sharper cones on the sides of the snap rings and making the solid wall rings to correspond, the force of the double-tapered wedge ring, crowding the wall rings laterally on a sharper cone, would decrease the diameter of the snap ring, regardless of the pressure under it, under which conditions the leverage would be too great, and would permit a blow over the outside of the snap ring. On the other hand, if the degree of angle on the snap ring were lessened and the cone made flatter, with wall rings to correspond, then the wedging power of the central wedge ring would not be sufficient to hold the snap rings from expanding by the pressure underneath them, and this would result in excess friction against the valve chamber, caused by inefficient leverage to lock the rings. The same effect can be reached in either direction by changing the degree of angle on the double-tapered wedge ring.

With this action clearly in one's mind, it will be seen that at whatever diameter of the cage the snap ring is locked up, in that diameter it will remain, unless it is locked up in a large part of a worn cage, for instance, and the movement of the valve forces it down into a smaller part of the cage, under which conditions the snap ring would be forced shut to the diameter of the cage at the smallest part. Under these conditions the snap ring would remain the smallest diameter of the cage, while the valve traveled back to the position of the original locking, and in that position there would be a blow over the outside diameter of the snap



SEMI-PLUG PISTON VALVE.

tact against the cage to prevent wear of the cages while the valve is working at short cut-off.

In addition to this it is absolutely necessary to prevent lateral wear. In order to accomplish all these necessary features, we have designed this Semi-plug piston valve on the principle of leverage by wedges, the pressure acting upon the wedges. In the valve the wedges take the form of cones, or circular wedges.

The outside walls of the snap rings, numbered on the print "1", are straight, and fit against the straight wall of the follower and spool. The inner walls of these snap rings are beveled, forming a cone. Next to the snap rings are wall rings, No. 2, the sides of which are beveled to fit the cones of the snap rings. These are called wall rings, because they form the inner walls of the snap rings. These wall rings are uncut, non-expansible steel rings. Between these wall rings, in the center, is placed a double-coned expansible ring, called a wedge ring, number 4, and which,

rings, the leverage of the double-tapered wedge ring, crowding the solid wall rings against the cones of the snap rings, is just sufficient to prevent the snap rings from further expansion, but not sufficient to reduce the snap rings in diameter. By a little consideration of the effect of changing the degrees of angles, it will be observed that the frictional contact of the snap rings against the valve chamber depends entirely upon these angles, and it can, therefore, be regulated to any desired degree.

Following the action of this valve, when steam is admitted to the steam chest, it passes through the small holes around the spool, and finds an outlet, first, under the first snap ring, and, second, under the central wedge ring. From 14 to 18 holes in the end of a valve. The velocity of the steam from these holes against the first snap ring insures its fitting the valve chamber, and the action against the wedge ring is to place it in position for the pressure to lock up the rings.

The packing consists of the com-

ring. It will be seen, therefore, that this valve will never wear a cage out of true, and it will also be observed that it is very important that the valve be put into a true cage to begin with. It will in time true a cage up, but this is an expensive, and would, therefore, be a foolish application.

The valves are made for internal or external admission, and have been made for both, that is, reversible, in which case the valve is used as a reversing gear by changing the steam to internal or external admission. The rings of this valve are all machined in their working diameters. The packing rings are properly lapped with a solid steel joint-plate, the side of which is beveled, bringing it to a sharp edge at the periphery of the ring, thereby avoiding any notches in the steamer exhaust lines of the valve. No material nor workmanship is spared to make these valves the most perfect possible. These valves are manufactured by The American Balance Valve Co., Jersey Shore, Pa.

ATLANTIC COAST NOTES.

Office of the MARINE REVIEW,
Room 1005, No. 90 West St.,
New York City.

The Italian liner Florida, which rammed and sank the White Star liner Republic, was sold at auction last week, the price being \$220,500. There is a hitch in the transaction, however, as M. A. Mosle of Philadelphia, the purchaser, has refused to accept the bill of sale offered to him by United States Commissioner Alexander, the trustee. The details of the matter are not known, but the purchaser, who paid down \$16,000, has been ordered to show cause why he should not be held to the terms of the sale.

The United Fruit Co.'s steamer Meridia, which ran ashore on the reefs of Main Cape Banks, twenty miles north-east of Cape Gracias, Nicaragua, on Feb. 28, is resting in an easy position and in all likelihood will be refloated. All the passengers were taken off the vessel on Monday by the steamer Bound Brook, which was sent to the relief of the Meridia, and which is also owned by the same company.

The United States revenue cutter Mohawk, which went on Little Hog Back reef in Hell Gate on Friday afternoon, has been taken to Showan's dry dock after being floated by two of the Merritt Chapman wrecking boats and several Government tugs. A contract has been made for repairs to the damaged vessel to be completed in a month, at a price, it is said, of \$11,-

000. A court of inquiry will be called to determine who is responsible for the accident.

The steamship Lucania, of the Cunard Line, arrived at New York on Sunday, a day late, owing to extremely heavy weather on the westbound passage. Several gales were encountered on the last day of the run, and owing to the heavy head seas Capt. Warr was forced to reduce the speed of the vessel.

The Anchor Line steamship Caledonia, while bound from Glasgow to New York, passed a gigantic iceberg on the morning of Feb. 25, in latitude 45.40, longitude 48.06. The berg was of unusual proportions, being over 150 ft. in height. Considerable field ice was also encountered. The Caledonia was compelled to slow down, causing a late arrival at the port of New York.

The stranded schooner Eugene Cathrall, which ran ashore on Two Mile Beach, N. J., was floated Monday by the Two Mile Beach and Cold Spring life saving crews. The Eugene Cathrall has a cargo of potatoes and corn, and was bound from Newton, Del., to Cape May when she went ashore.

The British steamship Nanette, from New York for New Orleans, already reported as overdue, is now reported to have been sighted near Ship Island Light on Feb. 28.

While bound for Galveston from London, the British steamship Rock Light ran short of bunker coal and was compelled to put into Halifax, N. S., on Saturday, for a fresh supply.

The King George, of the Standard Oil Co., arrived at New York this week with six of the crew suffering from beri-beri. When near the Straits of Sunda, enroute from the Orient, the cook became ill and died, several of the crew also being stricken down. When the King George came to anchor off Staten Island, the master of the ship and five men were removed to the Staten Island Marine Hospital.

The following board of directors and officers was recently elected for 1909 by the Munson Steamship Line, 82-92 Beaver St., New York: Carlos W. Munson, president; Alfred H. Bromell, vice president and secretary; Frank C. Munson, vice president and treasurer; Charles M. Dimm, assistant treasurer; John W. Reynolds, assistant secretary.

PIG IRON SITUATION.

Readjustment of conditions in the iron and steel market is proceeding in an orderly manner since the "open market" declaration. While only a moderate amount of business has been developed there is no disposition among manufacturers to take orders regardless of cost as in other years. Quotations on plates, shapes and steel bars are being well maintained, while talk of making Chicago a basing point is not indulged in. The Lackawanna Steel Co. has returned to the Pittsburg base for a time at least, although last week it based its quotations on Buffalo. The production of pig iron continues at a steadily increasing rate, the production for February reaching 1,681,423 tons. The demand is limited but prices are unchanged, although southern iron sells on the basis of \$12 Birmingham for No. 2. A fair amount of business is developing in steel bars, but structural contracts of heavy tonnage are not numerous. The wire business is very flourishing. Quotations on crude steel have finally been established at \$23 Pittsburg for rolling billets, and \$25 Pittsburg for sheet bars. Some fair sized contracts for foundry coke have been made. The old material market is still declining in prices.

Mr. M. P. McDonagh, general manager of the Seaford Marine Railway Co., Seaford, Del., closed contract last week for a Chesapeake schooner for Captain R. J. Bristow, Wm. V. Vane, Allen P. Vane and Wm. Michael, of Baltimore. The vessel is to be 107 ft. over all, 26 ft. beam and 6 ft. 4 in. hold, of the fast clipper type, and is to embody all the latest methods of marine architecture in design and construction. The vessel will be ready for sea by Sept. 1 next. Design and details of construction are now being worked out by the manager.

The Cleveland & Buffalo Transit Co. will open its season of navigation about April 15, operating the steamers City of Erie and City of Buffalo. The State of Ohio will be placed on the route about June 15 to stop at Erie.

The frame work of the steel light-house for White Shoals has been completed at the works of the Milwaukee Bridge Co., Milwaukee. It will be taken to White Shoals in the spring.

The Lake Superior Towing Co. of Bayfield, Wis., has been organized with a capital stock of \$20,000. The incorporators are Henry J. Wachsmuth, E. Miller and Wm. Douquette.

"In the Merchant Service"

The old freighter was ambling leisurely along, about the usual eight-knot gait, when the Alroma went tearing past, also westbound. Well, "tearing" isn't exactly the proper term to use, as the Alroma, though a liner, wasn't exactly in the first sweet blush of youth. She was, in fact, one of the several expensive old-timers in the North Atlantic trade, the kind that the men of the deck department anxiously await promotion from and the men of the engine department refer to as "holy terrors."

As she passed the freighter the passengers crowded to the rail of the liner, commenting in many tongues on the general appearance of the stranger. The decks of the freighter were deserted save for the officer on the bridge and a solitary sailor squatted on a hatch, patching a tarpaulin. A third figure appeared at the galley door to return the hail of the Alroma's passengers with a dingy table cloth.

"Ah, that's the life to live," said Johnson, the Alroma's fourth engineer; "there's nothing to beat an old tramp-ship when it comes to comfort."

"Well, you can have 'em all, so far as I am concerned," answered one of the other engineers in the little group, interestedly watching the passing of the tramp. "I arose to be chief in the tramping service, and it's a sorry life. You can judge as much when I was willing to start at the bottom of the ladder in a regular line, and in this blessed old hooker, too!"

"Think of it," pursued the fourth engineer, addressing no one in particular, "no boat musters or fire drills twice a week. No taking of indicator cards every few days to satisfy a strenuous chief. No writing out of sick reports and playing the part of understudy to a ship's doctor. No blessed overhauling of the whole darned engine when the ship is in port. No feeding on dainty dishes when a fellow is in a hurry to get a good square meal and get out on deck. No—"

"Hold hard!" interrupted the ex-chief of the tramping service. "There are probably three engineers on that ship we are now passing. The chief is probably on watch and—"

"But I've heard it said that the donkeyman looks after the boiler feed and oil 'round on the chief's watch," broke in the fourth engineer.

"Exactly so," said the ex-chief, "and if you could get aboard the tramp you would in all likelihood find the 'old man' sweating at the vise bench back of the

engines as he overhauled the tools for port use or found filling brasses, a mighty fine way to kill time. The second engineer is probably in bed, and the third in a furnace of the donkey boiler. If the boiler is in good shape, however, he may be only inside the boiler itself, helping a perspiring, protesting trimmer to remove some of the scale on the furnace crowns."

"Aw, they can't be at it all the time," argued the fourth engineer, "they're bound to get on deck occasionally."

"Nothing surer," said the ex-chief, smiling benignly on the fourth engineer, "the cargo winches need overhauling, for instance. That ship probably has about six on board, and the stevedore's men don't do a thing but drive the soul out of them when handling the cargo. You will notice the freeboard of that craft, and can imagine how often the decks will be dry enough for working on the winches with anything like comfort."

"You were saying," continued the ex-chief, "that on this ship, when any of your men are sick, you have to play



"A BREAK IN THE MONOTONY."

the part of understudy to the ship's doctor. Well, if you had any men laid off on a tramp you'd probably find yourself some fine day playing understudy to a ship's fireman. Some of you don't realize you are alive! You were also saying that what you might consider an unnecessary amount of overhauling here was not carried out on a tramp when in port, which is perfectly correct. You must remember, however, that overhauling on a tramp is what you might call a single-handed job, and there is always plenty of real overhauling to be done without opening up anything for examination as we do here."

"Well," protested the fourth, "you can't deny that a fellow has a much better chance of seeing the world on a tramp than he has in regular service."

"Sure," agreed the ex-chief, "but, as he only manages to get anything like a reasonable spell ashore at every third

port of call, it takes him a mighty long time to see the sights. I remember, for instance, when my ship first touched at Calcutta, I spent most of the time the ship was in port working on the boilers. I was third engineer then, and dying to get ashore and buy a few souvenirs, but as the chief was tending a hand most of the time and the second was patching a cracked condenser door, I didn't see where I had any kick coming. Talk about seeing the world through a port hole!"

"Say," said the fourth, impressively, "you certainly have got it down pretty fine. I have known several engineers of tramp steamers, and I don't remember ever hearing any of them making the kick you are giving us."

"For very good reasons," said the ex-chief, "How many of the tramp engineers did you allow to leave you under the impression that you were fourth engineer on the finest job afloat? I'll bet that you are mighty loyal to this old tub when you are out of her sight and hearing. Then, again, you were talking about fancy cooking, and deploring the fact that all you wanted was a good square meal. How many good square meals do you fancy you can get on a tramp? You ought to be around when the mess-boy carefully counts out two potatoes for the chief and three between the second and third! Some of you fellows think that salt horse and 'dog's body' are things of the past, but you musn't be mistaken on that score."

They stood in silence watching the tramp fade in the gathering twilight, each man busy with his own thoughts. Along the deck of the old liner the bugles were calling the passengers to dinner.

Later, when the ex-chief arose from the dining table and made his way to the door of the mess room, he passed the fourth engineer of the Alroma in the act of finishing a hearty meal.

"Let's see," he murmured, with a quiet smile, as he scanned the table in front of his superior, "apple pudding, ice cream, chocolate eclairs and coffee. Who wouldn't be engineer on even an old liner!"

THE "STAND-BY" MAN.

A change has recently been made in the naval regulations which will permit a naval commander to have command of a battleship. Officers of this rank have not heretofore been allowed to command vessels of greater importance than a protected cruiser. Commander Sims, naval aid to President Roosevelt, will be put in command of one of the battleships early next month.

The Propulsion of Ships by Internal-Combustion Engines.

BY F. DEKEYSER, C. E., IN THE *Ship Builder*.

As the problems connected with the propulsion of ships by means of internal-combustion engines are daily coming more to the front, it may be of interest to relate briefly what has been accomplished up to the present in this direction. The chief reasons why this form of propulsion commends itself are (1) the absence of boilers, casings, funnels, etc., and (2) the economy effected in fuel consumption. The

generation of fuel in gas engines. For moderate powers, the generating plant is frequently of the suction type, in which case gas is drawn from it a little under atmospheric pressure. In other types gas is delivered to the engines under compression. The former system seems preferable for marine purposes, since there is no danger of leakage. Various types of gas producer have been devised, the chief dif-

ferences arising from the kind of coal (anthracite or bituminous) to be used. For the purpose of illustration, we have selected the "Capitaine" suction gas plant. The installation shown in Fig. 1 consists of a cylindrical shell (A) lined with fire-bricks and having a feed hopper on top, steam and air

for generating purposes being supplied from below. The gas first passes through a cooling vessel (B), next through a cleanser (C), where all particles of dust and impurities are mixed with a fine spray of water, and then the gas is purified by passing through a centrifugal apparatus (D). This plant is specially designed for anthracite, from which a comparatively pure gas is obtained. When bituminous coal is used, however, tar and other by-products are obtained, which obstruct the engine valves. In this case the gases, after being generated may have to pass first over the lower and hottest parts of the generator in order to decompose these by-products, as in the Duff-Whitfield producer. In other systems the coal is supplied from below direct to the hottest parts so as to decompose the tar at once, as in the Boutillier suction plant. Other means for cleansing the gas have also been adopted.

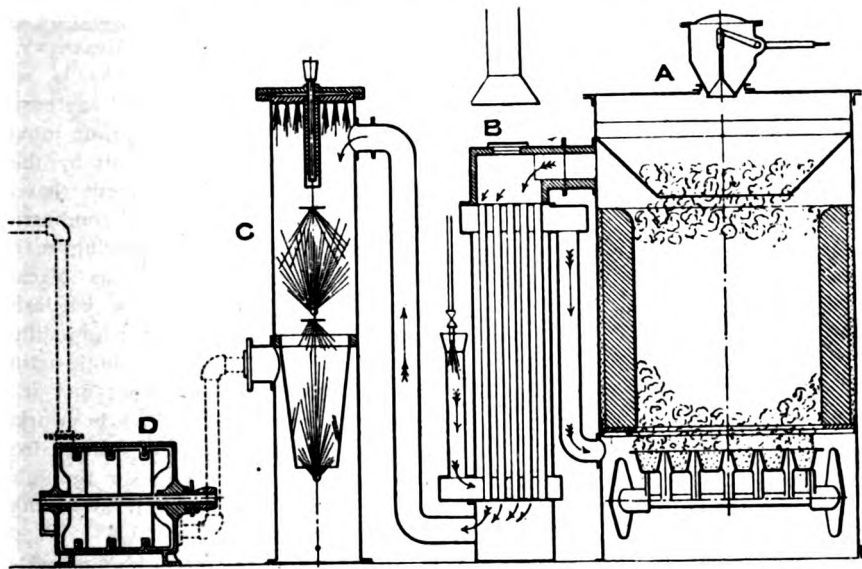


Fig. 1. - "Capitaine" Suction Gas Plant.

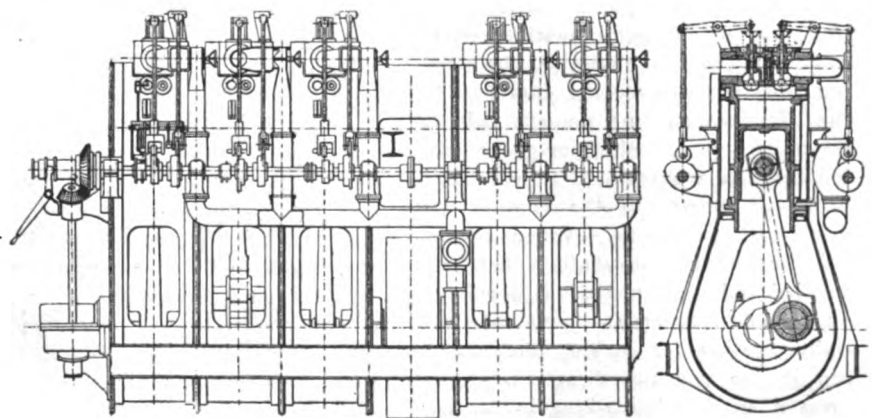
reduction of machinery space is specially marked with oil engines. Other advantages will be referred to later.

The development of the marine internal-combustion engine has been somewhat slow, but its general adoption appears now to be only a question of time. The fuel used is either gas or oil, depending mainly upon where the vessel is intended to trade and upon the price at which the fuel is obtainable. In Great Britain gas engines appear to be preferred, owing to the abundance of coal from which the gas is generated. In other countries, notably in Russia, oil engines are more favored, since cheap and plentiful supplies of petroleum are available. Internal-combustion engines may be either single or double-acting, and of the two or four-stroke type, according to whether the explosions occur every second or fourth stroke.

First, let us deal briefly with the

ferences arising from the kind of coal (anthracite or bituminous) to be used.

For the purpose of illustration, we have selected the "Capitaine" suction gas plant. The installation shown in Fig. 1 consists of a cylindrical shell (A) lined with fire-bricks and having a feed hopper on top, steam and air



Figs. 2 and 3. - 500 H.P. Gas Engine of H.M.S. "Rattler."

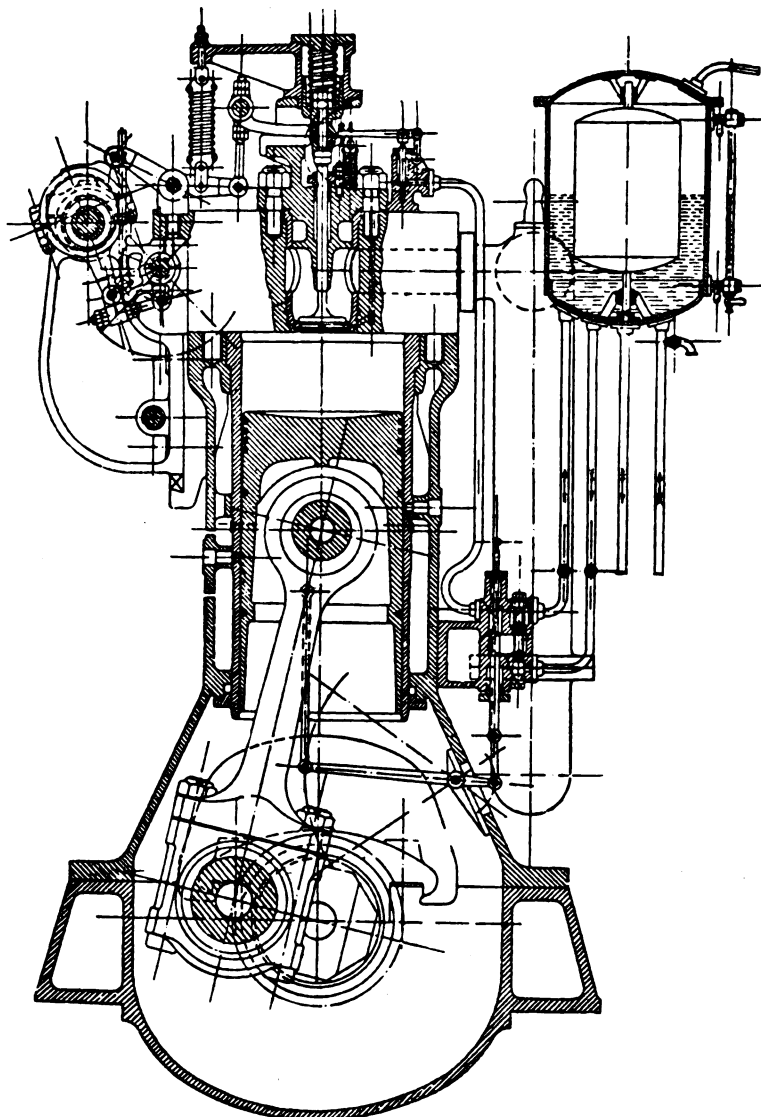


FIG. 4—VOGT MARINE GAS OR OIL ENGINE.

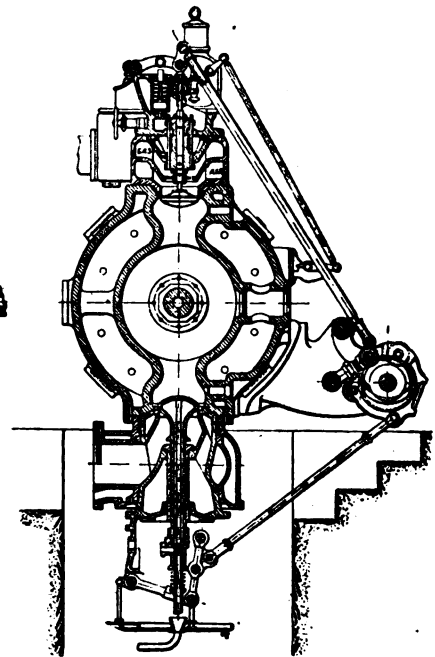
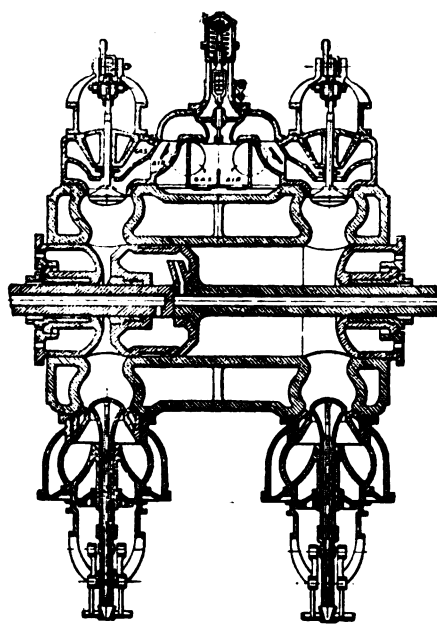
ameter, which is about the largest size stroke. The cylinders are 20 in. in diameter, considered safe with non-cooled pistons. The inlet and outlet of gases are operated by means of cam-shafts, placed on each side of the cylinders, the valves being operated by means of rocking levers. The framing is entirely built up with plates and angle bars.

One of the greatest difficulties to be overcome in connection with internal-combustion marine engines is the starting and reversing of the engines. In the Rattler, starting is effected by means of compressed air or gas, admitted through a special set of valves, in order to impart to the engines the first few revolutions. When reversing the engine, the shaft is first uncoupled and the cam-shaft is acted upon so as to bring the cams into the right position for making the engine run in the opposite direction. Compressed air is admitted again for the first revolutions, and the shaft is re-

coupled to the engine by means of a hydraulic clutch. There are two systems of ignition, viz., one of the low-tension magneto type and another of the high-tension lodge system. Forced lubrication is used for all bearing, etc. Gas is supplied by a producer plant of the same type as illustrated in Fig. 1, but with slight modifications and improvements in details. It may be added that Messrs. Beardmore have built another similar engine of 1,000 H. P., but double-acting and having water-cooled pistons. If size permits, however, a single-acting engine seems preferable, on account of its simpler construction, easier access for cleaning, and the non-cooling of the pistons. Water-cooled pistons adding considerably to the first cost.

Fig. 4 illustrates a Voigt marine gas or oil engine as built by Messrs. Vickers, Sons and Maxim. As is well known, this firm has had extensive experience in this type of prime mover, most of the submarines built by them for the British Government having been fitted with internal-combustion engines; and their engineering manager, James McKechnie, has already made a proposal to fit a battleship with such engines. The engine illustrated in Fig. 4 is of the single-acting, reversible, two-stroke type; and it is claimed for it that it can be worked by either gas or oil, the change from one method of working to the other being effected very simply and almost instantaneously.

Mr. Vennel-Coster, of Manchester, has also built comparatively large sets of marine gas engines, but working on



FIGS. 5 AND 6—KOERTING DOUBLE-ACTING GAS ENGINE.

the Otto cycle (four-stroke type). Generally speaking, all these systems have given equally satisfactory results, and it is, therefore, difficult to say which offers the greatest advantages.

As the marine gas engine is only following the lead taken in land gas engines, it will not be out of place to offer a few remarks concerning the latter. Ten or twelve years ago engines of 500 to 600 H. P. were built

der. The mixture chamber with the inlet of gas and air is in the center. Large jacketing is shown all round the cylinder, including the stuffing box packing, as is also shown the piston jacketing with inlet along the piston rod and outlet through the tail-rod. As the exhaust valves underneath the cylinder take up considerable space, the cylinder is supported at the ends only. A single glance at the design

three sets of 100 B. H. P. kerosene motors, having four cylinders each of 8 in. diameter and 8 in. stroke, making 750 revolutions per minute. Lubrication is forced to all bearings. The starting is effected by compressed air, supplied by a 6 B. H. P. motor and compressor, and reversing is accomplished by means of clutches, which make the whole plant as easily controlled as a steam engine. Reduced

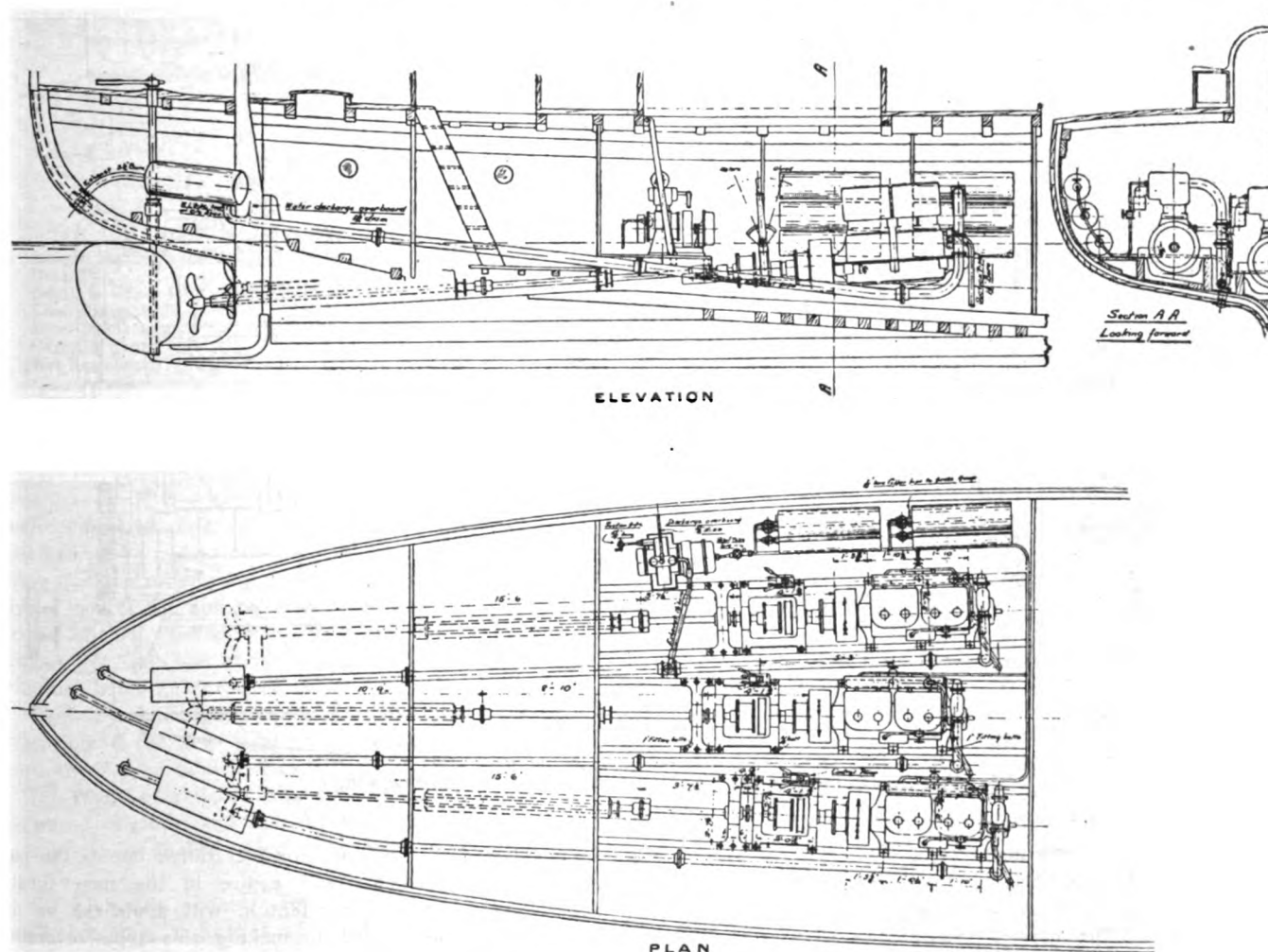


FIG. 7—GENERAL ARRANGEMENT OF MACHINERY IN THE TRIPLE-SCREW YACHT BRONZEWING.

on the Continent for the purpose of utilizing the waste gases of blast furnaces, and were called "poor gas engines". The types manufactured by the Deutz, Augsburg, Cockerill, Korting and Oechelhauser companies may be considered the most up-to-date, and there exist quite a number of these engines of from 1,000 to 1,200 H. P., and even higher powers. In the United States, engines up to 4,000 and 5,000 H. P. have been built. Figs. 5 and 6 are sections of a Korting double-acting gas engine, which is one of the horizontal non-reversible type, with inlet valves on top and exhaust valves at the bottom of each end of the cylin-

der. The mixture chamber with the inlet of gas and air is in the center. Large jacketing is shown all round the cylinder, including the stuffing box packing, as is also shown the piston jacketing with inlet along the piston rod and outlet through the tail-rod. As the exhaust valves underneath the cylinder take up considerable space, the cylinder is supported at the ends only. A single glance at the design

shows its complicated nature, which is bound to further increase if applied to vertical engines and if a reversing gear be added. It is not surprising, therefore, that progress with the marine gas engine has been slow. In regard to oil engines, we will only consider the Thornycroft and Diesel motors. The former has been fitted in a great many small craft, and may be considered as one of the best types of marine motors built in this country. Figs. 7 and 8 represent a set of engines just fitted by Messrs. Thornycroft in the triple-screw yacht Bronzewing, 120 ft. long by 17 ft. 6 in. beam. The machinery consists of

speed is obtained by leaving out either the center or both wing motors.

The Diesel motor, which has been specially developed on the Continent, and up to the present appears perhaps the best adapted for marine purposes on a large scale, is a single-acting, four-stroke, non-reversible marine engine, and therefore leaves room for improvement in regard to reversibility. In the first applications the difficulty was overcome by driving the shafts with electric motors. The next step was to drive the shafts directly from the main engines for ahead motion. Then going astern an electric motor is thrown into action, requiring only

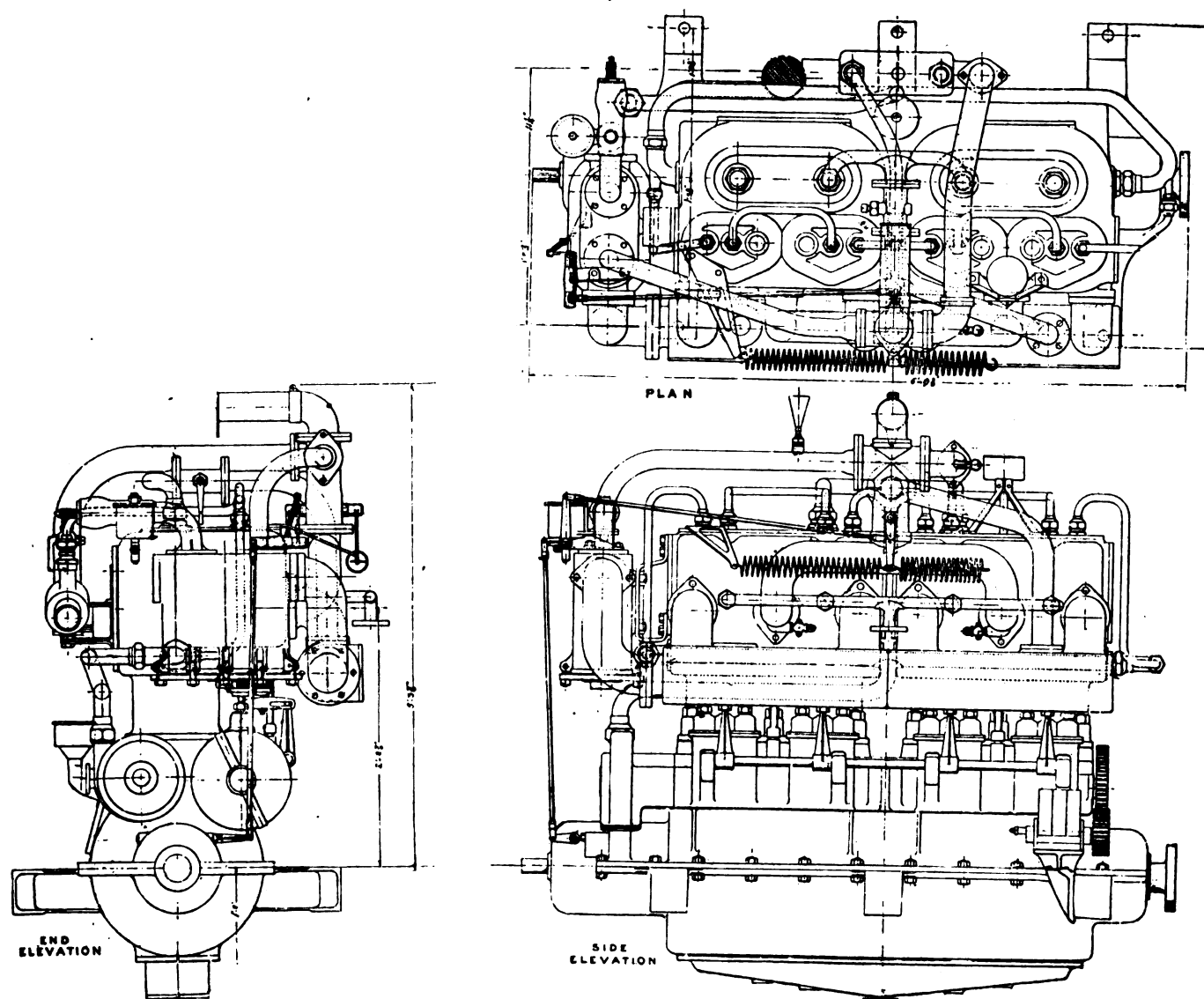


Fig. 8.—Details of Motor, Triple-screw Yacht "Bronzewing."

half the power of the main engines, so that it may be overloaded 100 per cent without inconvenience for short periods only. The connections to the shafts are obtained by means of a Del Proposto magnetic clutch, which has already been described and illustrated in these columns. This system has been applied to the propulsion of barges on the Rhine, and also in Russia for petroleum tank steamers up to 245 ft. long; requiring two 180 B. H. P. motors for a speed of 10 knots, the total weight of machinery being about 352 lb. per I. H. P. Several French submarines are fitted with Diesel motors, and they are also in use in the German navy. Professor Boklewsky, of St. Petersburg, has made a proposal for a triple-screw passenger steamer 240 ft. long, to be propelled by Diesel-Del Proposto machinery, and specially adapted for the trade between Odessa and Vladivos-

tock. This design is illustrated in Fig. 9, which is reproduced from a pamphlet by Mr. A. Lecoite, of Brussels. Provision has been made for 600 tons of oil fuel, which is assumed amply sufficient for a return journey, say 20,000 miles, at a speed of 10 knots. Professor Koklewsky has prepared an estimate of the yearly saving in running a steamer propelled by this method as compared with the vessels now running on the line, assuming both to be fully occupied all the year round. He reckons that, owing to dispensing with firemen, reduced fuel consumption, and increased cargo capacity and passenger accommodation, the annual gross earnings should be increased by 25 per cent, which would mean an increase of 8 per cent on the capital involved.

It should be added that the development of the Diesel engine has been retarded to a certain extent by com-

mercial considerations; but as the patents will expire in the near future, more attention will doubtless be devoted to making this type reversible and double-acting, and consequently more suitable for marine purposes on a large scale. Internal-combustion engines are now being extensively fitted in yachts. Lloyd's latest returns include 650 oil or petroleum-propelled yachts for British and 1,400 for American registry.

With further reference to the advantages of internal-combustion engines, the following figures give an idea of the economy in fuel consumption as compared with that of steam engines. For plants of 500 H. P. and upwards, steam engines consume say 1.60 lb. of coal per I. H. P. per hour, while gas engines require only 0.8 lb. and oil engines (petroleum) 0.4 lb. At lower powers the difference between the consumption of steam and inter-

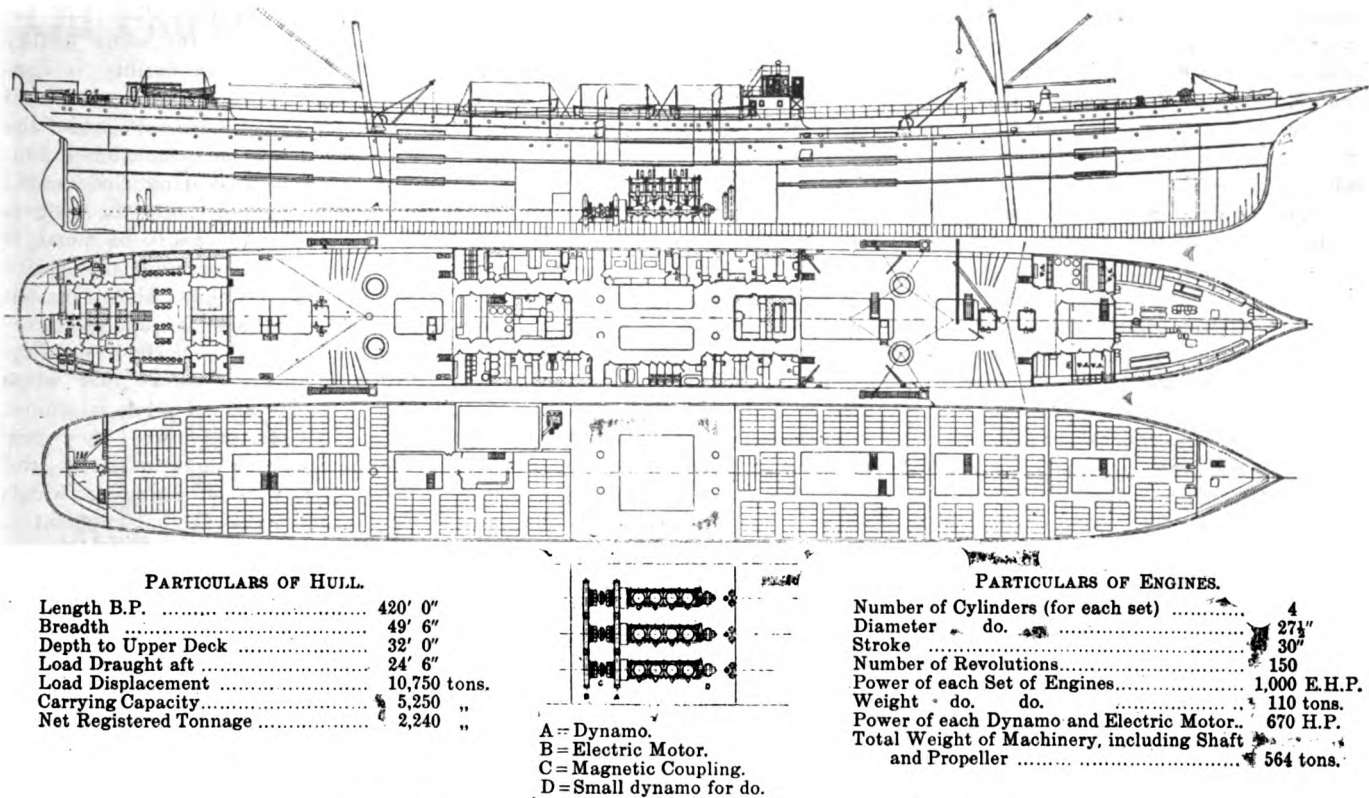


Fig. 9.—Proposed 420ft. Passenger Steamer with Diesel-Del Proposto Machinery.

nal-combustion engines is still more marked. The comparative cost of running gas and oil engines depends mainly, of course, on the price of the two kinds of fuel, the absence of generating plant and the easier stowage of oil fuel being in favor of oil engines.

The disadvantages attending the adoption of the new form of ship-propulsion may be tabulated as follows:

(1) Want of reliable data for high-powered engines, and complication of design when double-acting is resorted to.

(2) Elaborate process for starting and reversing, and want of flexibility in the latter quality. This has been overcome in the Diesel-Del Proposto system, but at the cost of additional electrical plant.

(3) Great number of cylinders required for high powers, especially at the present stage. On the other hand, the number of cylinders reduces the inconvenience when one of them is thrown out of action, as it may be disconnected and examined without interfering with the others.

(4) Comparatively high cost of oil.

(5) Possible troubles with igniters, miss-firing, back-firing, premature-firing, etc.

These difficulties, however, are gradually being overcome with increased experience, and in the near future it may reasonably be expected that they will largely disappear.

Repair of Marine Boilers by Autogenous Welding.

A very interesting and comprehensive paper on the employment of autogenous welding for the repair of marine boilers, by M. Andre Le Chatelier, appears in the *Revue de Metallurgie* for November, 1908.

For the repair of all classes of boilers the process offers two advantages of capital importance: first, it permits water-tight and durable repairs to be made without the use of rivets, which, although the only method of repair available up to very recent times, has always proved unsatisfactory on account of the tendency of riveted repairs to develop leaks after a greater or less period of service; and, second, it offers a means of effecting repairs impossible by any other process, and in many cases of avoiding the necessity of replacing furnaces or other important parts of boilers or even of whole boilers. Extensive corrosion of the tube plate, due to leakage of the tubes, or of certain parts of the furnace walls where a riveted patch could not be counted on to remain water-tight would in most cases lead to the condemnation of the entire boiler. The repair of such damage can be rapidly and cheap-

ly effected by the autogenous welding process and the cost of replacement of the whole boiler avoided.

In the particular case of marine boilers the process, generally the most economical method of repair under any circumstances, is of especial importance on account of the rapidity with which repairs can be executed. Repairs of any magnitude by riveting are not only expensive in themselves but they keep the vessel out of commission for days or, in many cases, for weeks. On this account boilers are usually kept in service as long as possible without repair with the result that deterioration goes on at a very rapid rate. Autogenous welding offers a means of effecting repairs of considerable importance during a stay of one or two days at a port, and a judicious and frequent utilization of the process results in keeping the boilers always in good condition. The process has a very important application in the case of boilers too badly damaged to be repaired by any other means. In many cases the costly replacement of certain important parts or of the whole boiler may be avoided or at least post-

poned for several years. This is especially of importance in the case of old vessels whose boilers are worn out but whose hulls are capable of several years' service, but not enough to warrant the installation of a complete new boiler plant.

Question of Safety Discussed.

The question of safety is of so much importance that in many quarters it is considered unwise to employ autogenous welding for the repair of boilers, especially for executing repairs of much importance. Distrust of the method has been caused by the fact that not infrequently welds made by inexperienced workmen break throughout their entire length. In considering the extent to which this distrust is well founded it is important to recall the modifications which take place in the mechanical properties of metals at temperatures around 200 degrees C. to which the boiler plates are subjected. These are, briefly, first, an increase in the ultimate strength in tension, second, a decrease of about 12 per cent. in ductility, and third, a decrease in malleability in about the same proportion. These modifications are produced by a transformation of which the nature is little understood and of which the effects are most clearly manifest between 100 to 200 degrees C., the range of temperatures to which boiler plates are commonly subjected. The most troublesome effect is the great reduction in ductility and malleability. The furnaces and fireboxes of boilers particularly are subjected to stresses due to expansion and contraction, which, notwithstanding special designs of plates used in their construction, eventually destroy the elasticity of the metal and give rise to the flaws and cracks which appear in the furnaces of all marine boilers at the end of a few years' service.

Modifications in Properties.

As regards repair by autogenous welding, however, these modifications in mechanical properties offer no difficulties. They are the same for the metal of the weld as for that of the plate. It is only necessary that the welding material should be a steel equivalent in quality to the material of the plate and of as low carbon content as possible, the latter because the reduction in malleability depends to a great extent on the amount of carbon present in the metal. A well-made weld will show resistance and extensibility values amounting to 80 per cent or more of those of the plate, a higher value than is possible with riveted repairs.

But the most important point to be considered in connection with autogenous welding is that of brittleness. At the point of welding the metal has been melted and cast and has lost a large part of its power of resistance to shock. It is possible to restore this quality to a certain extent by reheating the weld and by hammering at a red heat, but in general a weld can not be counted on to be so free from brittleness as the rolled plate. As a matter of fact the quality of fragility would not necessarily render a steel unfit for use in boiler construction were it not accompanied by its correlative fissility. The latter quality is of capital importance. In a fissile steel a crack once started is extended very rapidly by very small stresses. It is evident that a steel of this nature could not be incorporated in a boiler without the risk of serious accident. When a weld is badly made and does not extend through the whole thickness of the plate, the unwelded part forms the nucleus of a crack equally dangerous with those formed at the surface of the plate through the influence of expansion and contraction. Distrust of the autogenous welding process on this account merits serious consideration and seems at first sight justified by the frequent breakages of welds throughout their entire length under comparatively slight shocks.

The Influence of Temperature.

If welds made by this process retained when hot the fissility they might possess when cold it would indeed be unwise to employ autogenous welding to any great extent in the repair of boilers. But, fortunately, the temperatures between 100 and 200 degrees C. which have so serious an influence on the malleability of the steel have a most beneficial effect on the fragility and fissility. The latter are qualities characteristic of low temperatures and they diminish very rapidly as the temperature rises, a rise of even 5 degrees producing an appreciable improvement in the steel. Above 100 degrees they no longer exist, and between 100 and 200 degrees two steels which, when cold, would have shown very different degrees of fragility and fissility will be practically identical so far as these qualities are concerned. The result is that a crack which in cold metal would be extended by very slight shocks is increased only by considerable deformations at a temperature above 100 degrees. Hence a weld which might when cold be of a quality much in-

ferior to that of the plate will become of practically the same quality when hot, so far as fissility is concerned, and will possess no special danger. If badly made, of course, the flaw will increase in extent, but gradually and without the danger of sudden and complete rupture. If the weld is made with a good quality of metal, if it is uniform throughout the entire thickness of the plate, and if as an additional precaution it has been reheated, it will give perfect security. In fact experience shows that when welds in boiler plates fail it is almost always immediately after they are made, rupture being caused by the stresses due to contraction to which they are subjected at that moment.

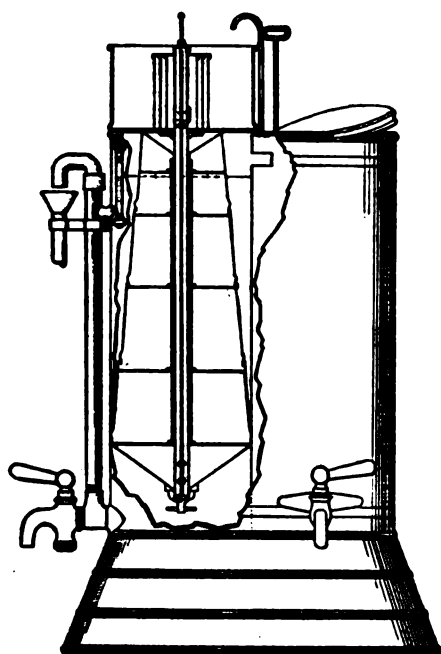
Various Applications of Welding.

M. Le Chatelier described at length the various applications of autogenous welding which may be made in the repair of various parts of marine boilers and gives numerous illustrations of work executed at Marseilles. He emphasizes the fact that the process is not simple. On the contrary it is a very delicate operation requiring for its success a great many precautions and a high degree of skill on the part of the workman. The lack of skilled workmen is the most serious obstacle in the way of the extension of the use of the process. The workman using it for the repair of boilers must not only be manually dexterous but he must have a keen sense of responsibility. The manual dexterity can be obtained in from 6 to 9 months but the moral qualities are so rarely found that there are not above ten workmen in the whole world, outside of Italy, to whom the more important repairs could be entrusted with perfect safety, and not above 20 others capable of performing satisfactorily the more ordinary operations. The process is, however, making rapid strides. At the end of 1907 it was used for repairing marine boilers only at the ports of Marseilles and Genoa, but during the past year it has been introduced in Belgium, Holland, Spain, Germany, England, Russia, Roumania and Brazil, and there is no doubt that within a few years facilities for executing repairs by autogenous welding will exist in every port of importance in the world.

The Moore & Scott Iron Works, San Francisco, Cal., were the lowest bidders for the construction of a steel barge for South America from designs by D. W. & R. Z. Dickie. The Moore & Scott Iron Works' bid was \$3,250.

Oil Filtration as Applied to the Modern Vessel.

Perhaps no feature of the equipment of the modern vessel has received so little serious consideration as the question of oil filtration, and the perfection of such apparatus as would accomplish efficient and satisfactory results. To persons familiar with the operation of large steamships it is a fact of common knowl-



AUTOMATIC OIL FILTER.

edge that large quantities of lubricating oil are used continuously, and in the vast majority of cases no systematic effort is made to reclaim any part of this product after it has passed over and through the various bearings of the engine and other machinery. While various opinions have been expressed as to the real value of the oil reclaimed, it has been proven beyond a doubt that with the installation of modern apparatus it is possible to reclaim from 50 to 75 per cent of the original product without in any manner detracting its lubricating properties.

A filter and purifier which is entirely automatic in its operation, and which can be used individually or in connection with a continuous automatic gravity oil filtering system, has been perfected by the American Automatic Oil Filter Co., of Philadelphia. The important feature of this device is the fact that absolutely no filtering material of any sort is used in the operation of the filter, which is as follows:

The waste oil, with the accompanying water and impurities, is pouring into the

receptacle A and percolates through the preliminary cleaners, B, B-1 and B-2, which collect about 98 per cent of the impurities. It then flows down through inlet holes C into pipe D, which is regulated by screwing up or down—finger tight—on reducing socket R, and from there down through center pipe D and out of holes at base of D-1. Entering the lowest series of plans, E F G H I, the oil ascends by gravity from the bottom pan and is checked by very fine perforated metal diaphragm E, which breaks it up into small globules and eliminates the suspended matter, after which it ascends through another pan of water which neutralizes any acid it may contain. It is again checked by diaphragm F, and so on until it goes through the diaphragms G-, H- and I. The purified oil flows out of top filtering pan J-J- and floats on top of water in outer filter chamber and into outlet pipe K, from whence it enters the oil storage tank. Nozzle L is a water outlet, and is a slip joint, which can be raised or lowered so as to keep the water in the gage glass at a fixed point.

The filter, when once charged, is entirely automatic in its action. Every drop of water that accompanies the oil, or that is put into the receptacle A, will displace a similar quantity of water at water outlet L, and every drop of oil that goes into the receptacle will displace a similar quantity at outlet pipe K. Pump N is convenient for filling oil cans, all drippings returning into the filter.

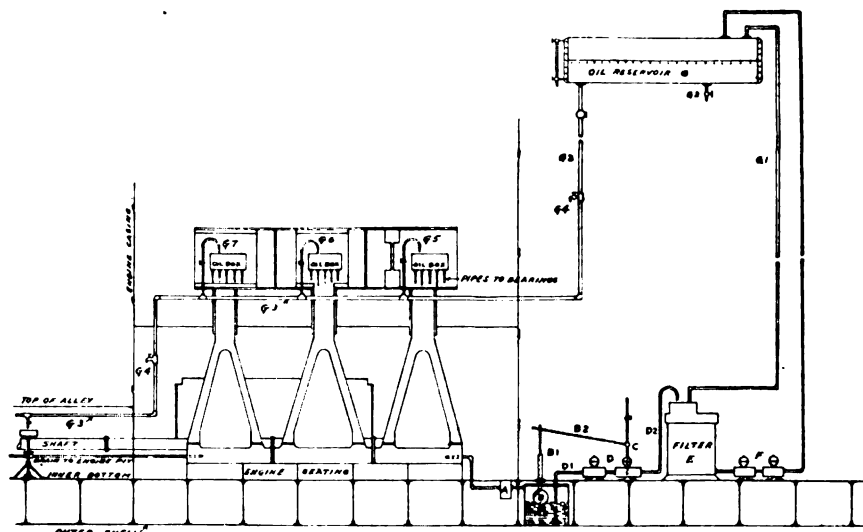
This system is the only one on the market that has successfully been ap-

plied to marine work, and the apparatus the only one guaranteed to separate salt water and foreign matter without in any manner disturbing the hydro-carbon or other essential elements of the original product, as has been proved by a series of chemical tests. The success attending the introduction of this apparatus in marine work has created considerable interest in the serious discussion of the subject of oil filtration as applied from an economic standpoint. The American Automatic Oil Filter Co. is prepared to furnish estimates, blue prints and specifications for a continuous system of any size and under any condition of marine work, and persons interested are advised that inquiries along this line will be welcomed.

The accompanying illustration shows the automatic filter installed aboardship in conjunction with the continuous automatic gravity oil filtering system.

VANGUARD LAUNCHED.

The British battleship *Vanguard*, the seventh of the Dreadnought class, was successfully launched at Barrow, Feb. 22. The keel of the *Vanguard* was laid down on April 1, 1908, and the contract calls for the completion of the vessel a year hence. It is believed, however, that she will be ready before the end of the present year, more work having been done on this vessel before launching than on any previous battleship. The *Vanguard* will be the heaviest of ships of her class, her launching weight being 16,000 tons. She is 500 ft. long between perpendiculars, 543 ft. long over all, 84 ft. beam; displacement, over 19,300 tons, horsepower, 25,000. Her cost will be upwards of \$9,000,000.



SHOWING THE INSTALLATION OF THE FILTER ABOARD SHIP.

STEAM-TURBINES IN THE NAVY From *Engineering*.

Considerable interest attaches to the trials of British warships during the year, as the majority of the vessels are fitted with Parsons turbines; but before dealing with these it may be stated that the few vessels already in commission fitted with this system continue to give most satisfactory results. The Dreadnought has finished two years' commission, during which she has done an exceptionally large amount of steaming. In fact, under the new regime the ships are at sea for a much longer period of time than has ever before been the case. This is all for the good of the service. Notwithstanding this greater amount of steaming done, and the frequency of stopping and getting under way at a changed rate of steaming, the cases of temporary disablement have been remarkably few, and show that the engineering branch of the navy is in a high state of efficiency.

TABLE III—TRIALS OF FIRST-CLASS TURBINE-DRIVEN TORPEDO BOATS IN 1908.

Name.	Type of Vessel.	Builders of Vessel and Makers of Machinery.	Speed on 6 Hours' Run, knots.
No. 13	Torpedo boat.	J. S. White & Co.	26.4
No. 14	Ditto	Ditto	26.6
No. 15	Ditto	Ditto	26.5
No. 17	Ditto	Messrs. Denny, of Dumbarton	26.2
No. 18	Ditto	Ditto	26.2
No. 19	Ditto	Messrs. Thornycroft	26.2
No. 20	Ditto	Ditto	26.5
No. 21	Ditto	Hawthorn, Leslie & Co.	26.2
No. 25	Ditto	J. S. White & Co.	26.2
No. 29	Ditto	Messrs. Denny, of Dumbarton	26.2
No. 30	Ditto	Ditto	26
No. 31	Ditto	Messrs. Thornycroft	26.4
No. 16	Ditto	J. S. White & Co.	26.5

markably low rate of 1.2 lb., which, of course, includes the fuel necessary for running all the auxiliary plant. The two reciprocating-engine ships averaged 1.9 lb. Objection may be taken to such a comparison because of possible variants. The mean result for the three cruisers of the In-

Duke of Edinburgh class the mean was 1.95 lb. At about one-fifth power the mean result for the three Invincible cruisers was 2.4 lb., whereas in the case of the Minotaur trio the mean was 1.87 lb., and in the six vessels of the Duke of Edinburgh class it was 2.05 lb., so that here, as in all cases, it is found that at low power the turbine is not so economical as the reciprocating engine. The Minotaur trio attained the desired speed of 25 knots, whilst the cruisers of the Invincible class, designed for 25 knots, proved themselves capable of 26 knots. The speed of the ships varied considerably, as a consequence of the adoption of different types of propellers, and no doubt opportunity will be taken at an early date of utilizing the experience gained with all three ships, in order to adopt the screw the proportions of which are found to be the most satisfactory.

In Table II. are given the trial results of the only torpedo-boat destroy-

TABLE I—STEAM TRIALS OF HIS MAJESTY'S ARMORED AND PROTECTED SHIPS IN 1908.

Name of ship.	Type of Ship	Builders of Ship.	Makers of Machinery.	Displacement.	Type of Boiler.	1st 30 hours' trial.		2d 30 hours' trial.		8 hours' full power.	
						I.H.P.	Coal per I.H.P. per hour.	I.H.P.	Coal per I.H.P. per hour.	I.H.P.	Coal per I.H.P. per hour.
Lord Nelson	Battleship	Messrs. Palmer	Palmer; Reciprocating engines.	16,500	Babcock and Wilcox	3,630	2.2	12,200	1.9	17,400	2.0
Bellerophon	Ditto	Portsmouth Yard	Fairfield Engineering Co.; Turbines.	18,600	Ditto	4,910	2.5	16,700	1.7	24,000	1.5
Defence	First-Class Cruiser	Pembroke Yard	Reciprocating engines.	14,600	Yarrow	5,780	1.9	19,500	1.8	27,500	1.8
Indomitable	Ditto	Fairfield Engineering Co.	Fairfield Engineering Co.; Turbines.	17,250	Babcock and Wilcox	8,480	2.6	29,300	1.6	43,700	1.2
Inflexible	Ditto	J. Brown & Co., Ltd.	J. Brown & Co., Ltd.; Turbines.	17,250	Yarrow	9,130	2.3	31,400	1.8	43,300	1.7
Invincible	Ditto	Armstrong, Whitworth & Co.	Humphrys, Tennant, Ltd.; Turbines.	17,250	Ditto	9,300	2.3	31,500	1.6	44,800	1.5

In Table I. the results are given of official steam trials of the new ships of the armoured class finished for the navy during the past year. The battleship Lord Nelson and the cruiser Defence are fitted with reciprocating machinery. The Bellerophon and the

TABLE II—TRIALS OF A TURBINE TORPEDO BOAT DESTROYER IN 1908.

Name.	Type of Vessel.	Builders of Vessel and Makers of Machinery.	Speed on Six Hours' Run, knots.
Amazon	Torpedo-boat destroyer	Thornycroft & Co.	33.2

three cruisers of the Invincible class are, however, fitted with turbine machinery. Most interest attaches to the coal consumption. It will be noted that at full power the average rate for the four ships was rather under 1.5 lb. of coal per horse-power hour. The Indomitable returned the re-

vincible class is under 1.5 lb., whereas in the case of the three cruisers of the immediately preceding class—the Minotaur trio—the average consumption at full power was 1.8 lb., and in the six cruisers of the Duke of Edinburgh and Warrior classes the mean result was 2.1 lb. The explanation is, of course, to be found in the fact that while in the Duke of Edinburgh the water consumption per unit of power developed by the main engines averaged 19 lb., the consumption for the Invincibles was about 13 lb. At lower power, however, the results are not quite so favorable. At what is regarded as the continuous cruising speed, when the Invincibles developed from 29,000 to 31,000 horsepower, the mean consumption was rather under 1.7 lb. In the case of the Minotaur trio the mean result was slightly higher—1.76 lb. of coal per indicated horse-power—whereas in the six vessels of the

er put through her paces during the year. In this case the legend speed was 33 knots, and on the six hours' run the actual rate was 33.2 knots. Four vessels of this class were tried in the preceding year, when the speeds varied between 25.67 and 34.5 knots, so that we have now in the service five vessels capable of maintaining 33 knots in favorable weather. The view, however, is entertained that it is better to make provision for heavy weather, and the new vessels to be built are to be made more seaworthy even at the expense of speed. Thirteen torpedo-boats have passed through their trial. These were originally regarded as coastal destroyers, but they have been more fitly classified later as torpedo-boats. Their displacement tonnage ranges from 240 to 270 tons, and their length from 172 ft. to 185 ft. With turbine machinery of 4000 indicated horsepower, the contractors

were required to guarantee a speed of 26 knots; and it will be seen that in the thirteen instances this has been achieved on the six hours' run. As with their destroyers, Messrs. White, of Cowes, have been especially successful with torpedo-boats, their speed averaging $26\frac{1}{2}$ knots. Messrs. Thornycroft have also succeeded in averaging over $26\frac{3}{4}$ knots, and in most other instances the rate was 26.2 knots. The conditions as to load and oil consumption were severe, and the Admiralty and the contractors alike are to be congratulated on the results.

RECIPROCATING ENGINE IN MARINE PRACTICE.

A paper by Mr. D. Gibson was read before the Manchester Association of Engineers recently, the subject being "The Reciprocating Engine in Marine Practice, and Its Probable Future." This paper reviewed the types of marine reciprocating engines, drawing attention to the most modern features of each, and to the considerations determining the choice of type. The types are classified as triple-expansion three-crank engines, quadruple-expansion four crank engines, and triple-expansion four-crank engines. After discussing various points with regard to these, the author dealt with steam-jacketing, superheating, etc., concluding by forecasting, as far as present indications render this possible, the future means of propulsion for the different classes of water-borne traffic. The author stated that about 70 per cent. of the world's commerce is carried on in three-crank triple-expansion engined ships. Such engines are suitable for all powers up to 4000 indicated horse-power per set, but the majority of these engines in use do not exceed 3,000 indicated horsepower per set. These vessels were driven at a speed of about 12 knots or so. The author suggested that if some speed-reducing gear could be devised capable of efficiently transmitting 1500 horsepower and upwards, turbines might ultimately be adopted for slow freight-carrying ships. Where vessels require 4000 indicated horse power and upwards per set, and trade to long distances, the quadruple-expansion four-crank engine finds most favor, with boiler pressure from 210 lb. to 220 lb. per square inch. The weight of such engines, with boilers, etc., compared with three-crank triple-expansion engines with 180 lb. boiler pressure, runs out about 8 to 10 per cent. heavier per indicated horse-power with the same revolutions, although the boiler proportions may be 5 per cent. less. The saving in fuel aver-

ages 6 to 7 per cent in favor of the quadruple type. In the cross-Channel L. and Y. railway steamers, fitted with triple-expansion four-crank engines, the weight per indicated horse-power of boilers, water, and all machinery was 254 lb. The author advocated the steam-jacketing of the intermediate cylinder. With regard to superheating, the author stated that with a superheat of 150 deg. Fahr. the economy gained was 12 to 15 per cent., and even 25 to 30 per cent. in the case of steamers which prime badly. As to the future, the author suggested that for fast cross-Channel service the saving in machinery weights of 20 per cent is in favor of the turbine, and other factors will probably tend to make this class of propulsion standard for this traffic. For fast Atlantic service the future seems to be with the turbine. For very large freight carriers the combination system of turbines and reciprocating engines seems to promise best, while for tramps and slow vessels using comparatively small power the three-crank triple-expansion engine seems likely to hold its own against any other form of steam propulsion as yet devised.

WATER SHEEP?

Most engineers can recall amusing experiences in connection with the translation of foreign engineering terms into English or vice versa by foreign correspondents who possess little knowledge of technical terms used in the profession. The case quoted below from the *Manchester Guardian* is worthy of a place amongst curiosities of this description. A business communication in Arabic recently reached a Manchester firm, and when translated by a Syrian interpreter proved to contain a request for the price of coppering "two water sheep" of certain given dimensions. The translator was confident of his version, but admitted that he did not know what water sheep could be. For the moment even the principals of the firm to whom the communication was addressed were puzzled, until it struck someone that this was the nearest synonym in the vocabulary of a pastoral people for "hydraulic rams."

A MOTOR DRIVEN TABLE SAW.

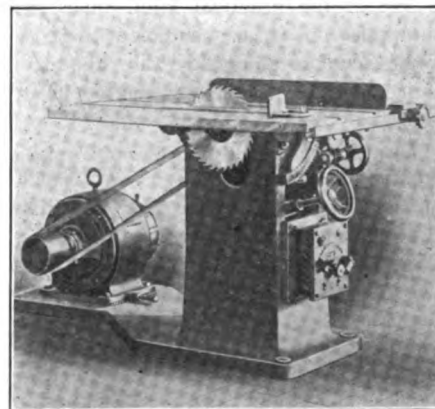
A tool for woodworking establishments which is to be especially commended on account of its convenience, and efficiency is the neat motor-driven table saw illustrated herewith. It is built by the Crescent Machine Co., Leetonia, Ohio.

The saw table proper and the saw

itself are supported upon a pedestal which also furnishes a frame upon which the mechanism for adjusting the saw and table, and the starting rheostat are mounted.

This adjusting mechanism consists of means for tilting the table and raising or lowering the saw. The former is accomplished by means of a hand wheel whose shaft bears a worm, with a graduated brass scale and pointer to show exactly the amount the table is tilted, up to 45 degrees. By means of the other hand wheel the saw is adjustable in a vertical direction, making the machine adapted for cutting boards of different thickness up to 4 inch. The saw itself may be as large as 14 inches, but no larger.

The motor equipment consists of a



CRESCENT MOTOR-DRIVEN TABLE SAW.

$3\frac{3}{4}$ -horsepower, totally enclosed Westinghouse type "R" motor and a starting rheostat. The motor is shunt-wound, and runs at a constant speed of 1,800 revolutions per minute on a direct current line voltage of 220 volts. The type "D" rheostat is equipped with an automatic low voltage release, and is used for starting only.

The motor is mounted on the extended base of the saw table proper. It is connected to the saw mandrel, by a belt which passes through an opening at the back of the pedestal.

A reference to the illustration shows the extreme ease of operation brought about by the motor equipment. The five operating handles are all within a radius of about one foot. The table can be adjusted and the saw started or stopped without the operator moving a step. The motor is behind the machine out of the way, and takes up no space that would otherwise be useful, being beneath the overhanging table. The machine can be located in any position desired, being independent of line shafts.

TRADE NOTES.

Dean Bros. Steam Pump Works, Indianapolis, Ind., have just issued pony catalog No. 76, descriptive of a few of the steam pump patterns which they carry.

The Fort Wayne Electric Works, Fort Wayne, Ind., have just issued Bulletin 1,109 devoted to multi-phase alternators engine driven; also a practical guide for transformer testing.

The American Brake Shoe & Foundry Co., Chicago Heights, Ill., has just issued a little circular concerning the manganese steel castings adaptable for a great variety of uses. The circular will be sent to any one upon request.

The Billmeyer Lumber Co., Third National Bank building, Cumberland, Md., have distributed to the trade their annual office calendar. This calendar is one of the practical kind, since the numerals on it are sufficiently large to be seen at a considerable distance, a circumstance much appreciated in an office.

The Falls Hollow Staybolt Co., Cuyahoga Falls, O., have just issued a calendar, the pictorial part of which is a reproduction of Henry P. Smith's painting of Washington's old home at Mt. Vernon. The company is also distributing its celluloid blotters, which it will send to any one upon request.

The Under-Feed Stoker Co., Marquette building, Chicago, has closed a contract with Mr. G. A. Tomlinson, Duluth, for the installation of six Jones stokers under the Niclausse boilers in the steamer Hoover and Mason. Mr. Tomlinson had already written the company that the installation of these stokers in the steamer James E. Davidson had greatly contributed to fuel economy and it is doubtless the satisfactory results obtained in the Davidson that leads him to close contract for the Hoover and Mason.

The George Stratford Oakum Co., of Jersey City, N. J., has just sent out to the trade a handsome calendar, at the top of which is a large picture of the famous schooner Gov. Ames, printed in a sea green duo type and mounted on a good sized board. Beneath this picture is printed: "Schooner Gov. Ames, is the first five-masted schooner ever built. She made her first trip 20 years ago from Portland, Me., to Buenos Ayres, with 1,896,000 ft. of lumber. Capt. C. A. Davis went around Cape Horn with her, spent three years on the Pacific coast, made a voyage to Australia, then to Honolulu, then to Puget sound and then to

Europe. She has been nearly around the world and has always made successful voyages. This vessel is calked with Stratford oakum."

The C. O. Bartlett & Snow Co., Cleveland, O., have just issued a catalog devoted to their coal and ash hauling machinery. During the past few years this company has constructed a number of fueling lighters for lake interests and have acquired an enviable reputation for efficiency. The catalog contains photographs and descriptive matter of the lighter John B. Razer, operated by M. A. Hanna & Co., at Ashtabula, and the Black Diamond, also established at Ashtabula. Views are also given of the fueling lighter Wm. G. Perry, at work in Cleveland harbor. The catalog will be sent to anyone interested.

The Revere Rubber Co., of Boston, are today offering a most complete, up-to-date line of sheet and piston packings, gaskets, pump valves, etc. They have recently issued an attractive catalog illustrating and describing their entire line. Special mention is made of the original "Usudurian" self-vulcanizing sheet packing, also the well-known line of "Black Hawk" and "Samson" packings. The reputation of this concern as manufacturers of high grade mechanical rubber goods is well known to the marine trade and their high grade policy has been strictly adhered to in the entire line of packings. The new packing catalog will be sent free for the asking.

The International Marine Signal Co., Ottawa, Can., has issued a booklet giving testimonials of mariners regarding the efficiency of the automatic acetylene gas buoys and beacons which have been established in various waterways by this company. While the company has only been in active business about four years it has sold no less than 277 buoys and 50 beacons. The company's patronage has been well distributed, embracing the United States and Canada, Brazil, England, India and Korea. Testimonials are submitted from famous mariners, including Capt. John Pritchard, master of the Cunard liner Mauretania and Capt. R. C. Warr, master of the Lucania. Altogether there are nearly 100 testimonials from steamship lines.

A. G. Cuthbert, 1750 North Rockwell street, Chicago, Ill., built during the year 1908 a number of yachts and launches, among which were the following: Wooden power boat Robert R. for inspection service in the sanitary district of Chicago; length over all, 70 ft.; value, \$15,000; she was fitted with a six-cylinder, four-cycle gasoline engine of 75 H. P. Open launch

38 ft. long and valued at \$2,000. Cabin launch for Gus Pearson, of Kansas City; length over all, 31 ft.; value, \$1,500. Racing yacht for syndicate of Chicago Yacht Club members; length over all, 36 ft.; value, \$3,200. Racing yacht for syndicate of Duluth Yacht Club members; length over all, 31 ft.; value, \$1,500. Steam launch for Marine Iron Works, Chicago; length over all, 36 ft.; value, \$3,000; fitted with a single screw fore-and-aft compound engine of 40 H. P. and water tube boiler. Steam launch for Marine Iron Works, Chicago; length over all, 36 ft.; value, \$3,000; fitted with a single screw fore-and-aft compound engine of 40 H. P. and water tube boiler. Cabin launch for A. G. Fay, Chicago, Ill.; length over all, 32 ft.; value, \$1,800; three-cylinder, four-cycle gasoline engine of 18 H. P. Cabin launch 32 ft. in length; value, \$1,600; two-cylinder, four-cycle gasoline engine of 12 H. P. A number of launches and yachts under 30 ft. were also constructed at this yard.

BUSY AT BELFAST.

The British shipbuilding trade appears to be on the mend according to the latest advices from Belfast. It is even stated that the yards there were never busier than at the present, there being about 75,000 tons of new shipping in various stages of completion at the fitting-out wharves while all the slips are occupied. Workman & Clark laid the keel last week for the new Cory Star boat, and it is reported that the same firm has secured an order for two new Holt liners for the Chinese trade.

At Harland & Wolff's establishment, where 15,000 men are at work, the keel plate of the giant White Star liner has recently been completed.

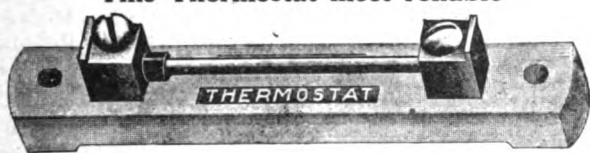
I. L. Snow & Co., Rockland, Me., will make repairs to the schooner Zacheus Sherman, which was recently towed into Hampton Roads in a water logged condition while bound from Brunswick to New York. She had been abandoned off Cape Henry. The Sherman is owned by the Benedict-Manson Marine Co., of New Haven, Conn.

The Matson Navigation Co., San Francisco, has let the contract for the construction of a steamer for its San Francisco-Hawaiian run to the Newport News Ship Building & Dry Dock Co. The new steamer will be an oil burner and will be 430 ft. long and 51 ft. beam.



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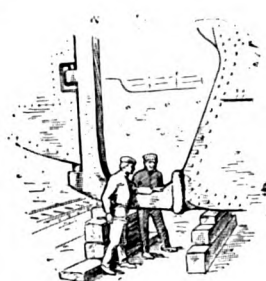
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SHIP YARD NOTES.

John W. Dickie & Sons, San Francisco, Cal., recently overhauled the steam schooner Rainier. She was given a new deck and the house was stiffened by adding diagonal straps.

The Tebo Yacht Basin Co., Brooklyn, N. Y., is getting out the timbers for the non-magnetic yacht Carnegie from a grove of large trees near Jamaica, Long Island, within the confines of greater New York.

It is reported that Philip Sloan, the well-known shipbuilder of Seattle, Wash., contemplates entering the shipbuilding and repair business at Tacoma, if a suitable site can be secured for the location of such a plant.

The Union Iron Works, San Francisco, Cal., was the successful bidder for effecting repairs to the lighthouse tender Kukui, bids for which were opened Feb. 6, its figure being \$677. Other bidders were United Engineering Works, \$706; W. A. Boole & Son, \$712.

The American liner St. Louis was dry docked at the New York navy yard Feb. 10, in order to ascertain just what damage she had sustained in losing part of her rudder during her rough voyage across the Atlantic. It developed that the rudder post was not injured and it was only necessary to fit the vessel with a new rudder. While in dry dock she was also given a new coat of paint.

There are three schooners under construction at Port Greville, Nova Scotia, one of 250 registered tons by G. M. Cochrane, one of 400 registered tons by Capt. George E. Bentley, and one of 275 registered tons by H. Elderkin & Co. At Parrsboro, N. S., Thomas Trahey & Son are building a schooner of 125 registered tons and Thomas McLaughlin is about to launch one of 150 registered tons.

James Rees & Sons Co., Pittsburg, Pa., has shipped a knocked down steel tug to Cairo, Egypt, for service on the upper Nile. The boat, which is a stern wheeler, has been christened Egypt. She is 140 ft. long, 26 ft. beam and 4½ ft. deep, with 21 watertight compartments. Her engines are of the cross compound type. The Egypt will be assembled at her destination by workmen sent by the Rees company for that purpose.

Bids received by Major H. Jervy, corps of engineers, United States army, opened Feb. 11, at Mobile, Ala., for the construction of 61 wooden pontoons, were as follows: Ollinger & Bruce Dry Dock Co., Mobile, Ala.,

\$16,000; A. F. Chastant & Sidoine E. Krebs, Scranton, Miss., \$12,500; Johnson Iron Works, Ltd., New Orleans, La., \$21,399; General Contract Co., New Orleans, La., \$22,082; Gulfport Towing Co., Gulfport, Miss., \$10,710; N. M. Flechas, Scranton, Miss., \$9,800; Thomas M. Favre, Gulfport, Miss., \$9,120.22; Charles G. Ollinger, Mobile, Ala., \$10,239; Gulf Dry Dock Co., Mobile, Ala., \$10,991; Salmen Brick & Lumber Co., Ltd., New Orleans, La., \$26,000.

Charles R. McCormick & Co., of San Francisco, Cal., are to have a new steamer built at the yard of the H. D. Bendixsen Shipbuilding Co., Eureka, Cal. She will be of the steam schooner type 200 ft. in length and will have a capacity of 1,000,000 ft. of lumber. The new vessel will cost about \$135,000. The McCormick Co. is the owner of the steam schooner Yosemite which cost \$110,000 to build and in two years and eight months earned \$94,000 clear.

The Risdon Iron Works, San Francisco, Cal., was awarded the contract for repairing the steamer Admiral Sampson, which was recently purchased by the Alaska Pacific Steam-

ship Co., on the Atlantic and taken around to San Francisco. The repairs to be made include fitting the vessel with oil-burning apparatus, the construction of a steel house aft to accommodate 90 second cabin passengers, an increase of accommodations for first class passengers to the number of 84, and a new forecastle. The contract calls for the completion of the work in 45 consecutive days. The bid of the Risdon Iron Works was in the neighborhood of \$75,000. Other bidders were the Moran Co., Seattle, Wash.; Union Iron Works, Moore & Scott Iron Works, United Engineering Works, Boole Bros., all of San Francisco.

William Cryer, East Oakland, Cal., launched the gasoline passenger boat Duchess recently. She is building for Lauritzen Bros., of Antioch, Cal., and is 85 ft. long over all, 15 ft. beam and 9 ft. depth of hold. The Duchess is of wood construction and is to be fitted with a 125-horsepower Atlas marine engine. She will have excellent accommodations for passengers, including a special cabin for Japanese, an entirely new departure on western craft.

SUMMARY OF NAVAL CONSTRUCTION.

The monthly summary of naval construction, issued by the bureau of construction and repair, shows the following progress upon vessels:

Name of Vessel.	Building at—	—1909—	
		Per Cent of Completion. Jan. 1.	Feb. 1.
BATTLESHIPS.			
South Carolina.....	Wm. Cramp & Sons.....	75.1	78.9
Michigan.....	New York S. B. Co.....	85.1	89.7
Delaware.....	Newport News S. B. Co.....	59.0	64.1
North Dakota.....	Fore River S. B. Co.....	67.4	70.6
Florida.....	Navy Yard, New York.....		3.3
Utah.....	New York S. B. Co.....		3.1
TORPEDO BOAT DESTROYERS.			
Smith.....	Wm. Cramp & Sons.....	62.8	65.2
Lamson.....	Wm. Cramp & Sons.....	61.8	63.8
Preston.....	New York S. B. Co.....	57.9	59.3
Flusser.....	Bath Iron Works.....	50.0	55.3
Reid.....	Bath Iron Works.....	48.5	54.6
Paulding.....	Bath Iron Works.....	3.0	3.7
Drayton.....	Bath Iron Works.....	3.0	3.7
Roe.....	Newport News S. B. Co.....	4.6	10.2
Terry.....	Newport News S. B. Co.....	4.8	9.5
Perkins.....	Fore River S. B. Co.....	3.8	6.7
Sterrett.....	Fore River S. B. Co.....	3.8	6.7
McCall.....	New York S. B. Co.....	3.4	5.8
Burrows.....	New York S. B. Co.....	3.3	5.8
Warrington.....	Wm. Cramp & Sons.....		6.2
Mayrant.....	Wm. Cramp & Sons.....		6.5
SUBMARINE TORPEDO BOATS.			
Stingray.....	Fore River S. B. Co.....	68.0	69.9
Tarpon.....	Fore River S. B. Co.....	66.9	71.0
Bonita.....	Fore River S. B. Co.....	63.0	68.4
Snapper.....	Fore River S. B. Co.....	62.3	65.6
Norwhal.....	Fore River S. B. Co.....	58.7	70.0
Grayling.....	Fore River S. B. Co.....	57.4	64.7
Salmon.....	Fore River S. B. Co.....	54.9	61.3
Seal, Lake Sub. T. B.....	Newport News S. B. Co.....		
COLLIERS.			
Vestal.....	Navy Yard, New York.....	98.5	98.6
Prometheus.....	Navy Yard, Mare Island.....	98.5	98.5
TUG BOATS.			
Patapsco.....	Navy Yard, Portsmouth.....	90.0	97.0
Patuxent.....	Navy Yard, Norfolk.....	97.0	98.0

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Great Lake Supply Co.	Buffalo & Duluth
Graham Sons	" "
Smith & Yendall	Detroit, Mich.
John N. Schlosser	Milwaukee, Wis.
Nic. Bur	Green Bay, Wis.
J. M. Sullivan	Chicago, Ill.
The Enterprise	Sheboygan, Wis.
Zepp Bros.	Toledo, O.
Schuette Bros. Co.	Manitowoc, Wis.
Tomlinson & Co.	" "
Chicago Lumber Co's. Store	Manistique, Mich.
Atkins & Co.	Escanaba, Mich.
H. Bittner	" "
Reagan & Gawn	Lorain, O.
Buckley & Douglass	Manistee, Mich.
Geo. Gougeon	W. Bay City
Walther Dept. Store	Bay City

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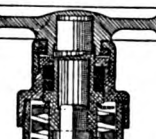
The Star indicates alternate insertions, the Dagger once a month.

Almy Water Tube Boiler Co.	67	Delany, P., & Co.	67	Kahnweiler's Sons, David.	77	Pittsburg Coal Co.	79
American Huhn Metallic Pack- ing Co.	69	Detroit Ship Building Co.	4	Katzenstein, L., & Co.	69	Pittsburg Forge & Iron Co.	16
American Injector Co.	83	Dixon, Joseph, Crucible Co.	64	Kidd, Joseph	81		
American Line	76	Donnelly Salvage & Wrecking Co.	77	Kingsford Foundry & Ma- chine Works	67	Quintard Iron Works Co.	11
American Manganese Bronze Co.	71	Douglas, G. L., & Co.	80	Knudsen-von Kothen Mfg. Co.	64		
American Sawdolet Co.	14	Drein, Thos., & Son.	77	Kremer, C. E.	80		
American Ship Building Co.	4	Dunbar & Sullivan Dredging Co.	75			Revere Rubber Co.	69
American Ship Windlass Co.	2	†Durable Wire Rope Co.	17			Richardson, W. C.	80
American Specialty Co.	Cover			Lake & Ocean Transportation Co.	81	*Ritchie, E. S., & Sons.	81
American Steel & Wire Co.	12	Ekenberg Milk Products Co.	63	*Le Mois Scientifique.	81	Roberts Safety Water-Tube Boiler Co.	67
Armstrong Cork Co.	77	Ekstrom, G.	81	†Linch, Chas. S., N. A. & M. E.	11	Roelker, H. B.	77
†Asbestos Composition Floor- ing Co.	14	Elphicke, C. W., & Co.	80	Lorain Coal & Dock Co.	79	Root, W. O.	81
†Ashton Valve Co.	16	†Empire Ship Building Co.	81	Lundin, A. P.	84	Ross Valve Co.	82
Atlantic Works, Boston.	82						
†Atlantic Works, Inc., Phila- delphia	15	Falls Hollow Staybolt Co.	65			Safety Car Heating & Light- ing Co.	11
		Fix's, S., Sons.	82			Scherzer Rolling Lift Bridge Co.	13
Babcock & Penton.	81	Fletcher, W. & A., Co.	82	Manistee Iron Works Co.	65	Schrader's, A., Sons, Inc.	77
Baker, Howard H., & Co.	66	Fogg, M. W.	77	Manitowoc Boiler Works.	65	†Seneca Chain Co.	17
Baldt Anchor Co.	71	Fore River Ship Building Co.	82	McCarthy, T. R.	80	Shaw, Warren, Cady & Oakes	80
Bartlett, C. O., & Snow Co.	77	Furstenau, M. C.	81	McCurdy, George L.	61	Sheriffs Mfg. Co.	71
Belcher, Fred P.	80			MacDonald, Ray G.	80	Shipping World.	—
*Boat Handling Gear Co.	83	General Electric Co.	84	McIntyre & Henderson	66	Siggers & Siggers.	77
Boland & Cornelius.	80	Gilchrist, Albert J.	80	†Marine Iron Co.	62	Smith Coal & Dock Co.	79
*Boston & Lockport Block Co.	79	Gillett & Eaton.	66	Marshall, Alexander	80	Speddy, Jos. H.	80
†Boucher Mfg. Co., H. E.	14	†Goldschmidt Thermit Co.	61	Martin-Barriss Co.	82	Starke, C. H., Dredge & Dock Co.	75
Bowers, L. M., & Co.	71	Goulder, Holding & Masten.	80	Maryland Steel Co.	10	Stratford, Geo., Oakum Co.	82
Breymann, G. H., & Bros.	75	Great Lakes Dredge & Dock Co.	75	McArthur Portable Fire Escape Co.	13	Strehlinger Marine Engine Co.	77
Briggs, Marvin	66	Great Lakes Engineering Wks Co.	18	Mehl, Edward	80	Sullivan, D., & Co.	80
†Brown Hoisting Machinery Co.	3	Great Lakes Register.	76	†Michigan Lubricator Co.	3	Sullivan, M.	75
Buffalo Dredging Co.	75	†Great Lakes Supply Co.	63	Milwaukee Dry Dock Co.	5	†Superior Iron Works.	73
Buffalo Dry Dock Co.	5	*Great Lakes Towing Co.	76	Mitchell & Co.	80	Superior Ship Building Co.	4
Bunker, E. A.	84	†Griscam-Spencer Co.	61	Moran Co.	11		
				Montauk Fire Detecting Wire Co.	61		
Calvin Co.	76	Hall, John B.	80	Morse, A. J., & Son.	77	Thornycroft & Co., Ltd., John I.	71
†Camden Anchor-Rockland Ma- chine Co.	15	Hall Bros. Marine Ry. & Ship Building Co.	9			Tietjen & Lang Dry Dock Co.	11
†Case & Son, A. Wells.	71	Hanna, M. A., & Co.	79	Nacey & Hynd.	81	Toledo Ship Building Co.	5
†C. & C. Electric Co.	71	Hawgood, W. A., & Co.	80	*National Tube Co.	83	Trout, H. G.	71
Chase Machine Co.	73	Hayward Co., The	15	Nevins & Smith	81	Truscott Boat Mfg. Co.	76
Chicago Ship Building Co.	4	Helm, D. T., & Co.	80	Newport News Ship Building & Dry Dock Co.	6		
Cleveland City Forge & Iron Co.	82	Holmes, Samuel	80	New York Ship Building Co.	7	Under-Feed Stoker Co. of America	65
Clyde Ship Building & Engi- neering Co.	9	Home Rubber Co.	69	Normand & Co.	75	Upson-Walton Co.	63
*Collingwood Ship Building Co.	9	Hoyt, Dustin, Kelley, Mc- Keen & Andrews.	80				
†Columbian Rope Co.	17	Hunt, Robert W., & Co.	81	O'Connor, J. J.	80	Vance & Joys Co.	80
Continental Iron Works.	2	Hutchinson & Co.	80	Otis Steel Co.	17		
Cook's Sons, Adam.	77	Hvde Windlass Co.	83			Walker, Thomas, & Son.	2
Copeland Co., E. T.	67	Hyner, P. D.	80			*Watson-Stillman Co.	83
Cory, Chas., & Son.	82					†Willoughby, A. B.	2
Cramp, Wm., & Sons, S. & E. B. Co.	8	†Ideal Pump Governor Co.	65			Wood, W. J.	81
†Crescent Machine Co.	14	International Mercantile Ma- rine Co.	76			†Wilby, Carlton	81
Curr, Robert	81					Willcox, Peck & Hughes.	66
		Jenkin Brothers	84				
Dake Engine Co.	3	Jenkins, Russell & Eichelber- ger	80	Parker Bros. Co.	80		
Davey, W. O., & Sons.	69	Johnston Brothers	67	†Peckham, O. P.	63		
				Penberthy Injector Co.	84		
				Pickands, Mather & Co.	79		

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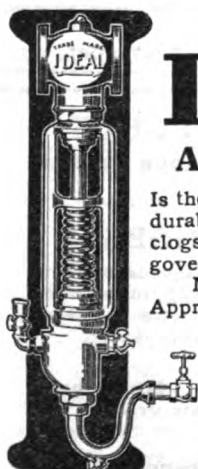
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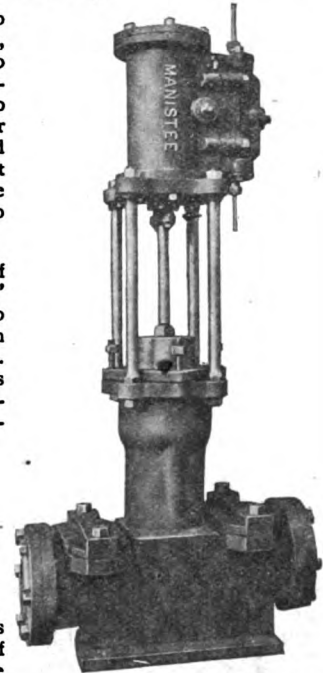
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This photograph of the "MANISTEE" Upright Bilge Pump shows the 6-inch x 6-inch x 10-inch stroke pump. We make these pumps either upright or horizontal, in any of the following sizes:

4" x 4" x 6"
5" x 5" x 8"
6" x 6" x 10"
8" x 8" x 12"
10" x 10" x 12"
12" x 12" x 12"

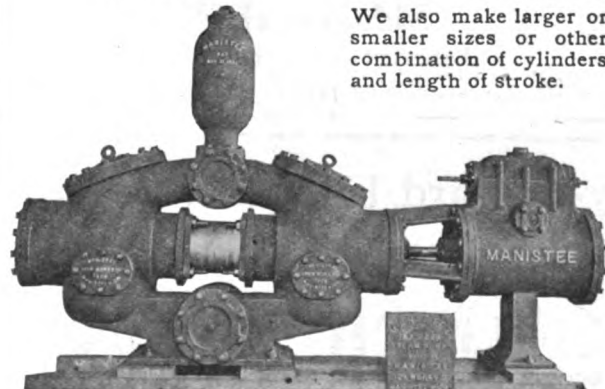


We also make larger sizes and other combination of cylinders or longer stroke to suit special requirements and floor space. They can also be made at any angle to fit on skin of boat if required.

This photograph of the "MANISTEE" Centrally Packed Plunger Pump shows the 18-inch x 12-inch x 24-inch pump. We make these pumps in the following sizes:

4" x 2 3/8" x 5"	14" x 8" x 12"
5" x 3" x 6"	16" x 10" x 18"
6" x 3 5/8" x 8"	18" x 12" x 24"
7" x 4" x 8"	20" x 14" x 24"
8" x 5" x 10"	24" x 16" x 24"
10" x 6" x 12"	30" x 18" x 24"
12" x 7 1/4" x 12"	

We also make larger or smaller sizes or other combination of cylinders and length of stroke.



All of our pumps can be made with compound cylinders, if required.

CLASSIFIED ADVERTISING SERVICE

PROPOSALS.—Sale of U. S. S. *Inca*.—Sealed proposals will be received at the Navy Department until noon of the 17th day of March, 1909, at which time and place they will be opened, for the purchase of the U. S. S. *Inca*; appraised value, \$5,300. The vessel will be sold for cash to the person or persons or the corporation or corporations offering the highest price therefor. *Proposals must be submitted in a sealed envelope addressed to the Secretary of the Navy, Washington, D. C., endorsed "Proposals for the purchase of the U. S. S. Inca," and each proposal must be accompanied by a satisfactory certified check for not less than 10 per cent of the amount of the offer.* On application to the Navy Department forms of bids and bonds, together with the terms and conditions of sale, also a printed list giving general information concerning the vessel, will be furnished. The vessel can be examined at any time after the date hereof by applying to the Commandant of the Navy Yard, Boston, Mass. It must be removed from the limits of the navy yard within such reasonable time as may be fixed by the Department. The Department reserves the right to withdraw the vessel from sale and to reject any or all bids. **TRUMAN H. NEWBERRY, Secretary of the Navy.** 2-11-09

SECOND HAND DOUBLE FIRE box boilers for sale, out of steamer "Mohegan," 16 ft. long by 12 ft. diameter shell, two 13-in. flues and two 32-in. flues, allowed 120 pounds steam, United States inspection. A bargain. Address Graves, Bigwood & Co., Buffalo, N.Y.

STEAMER AND CONSORT FOR sale. We offer the Steamer "Niko" and Consort "Annie M. Peterson," lumber capacity of both, from 1,650 M. to 1,700 M. ft.; coal capacity, 1,150 and 1,300 tons. Boats now laid up in Chicago and open for inspection. Both are in good condition and are for sale for cash. For further information address J. A. Calbick Co., 2 Sherman St., Chicago, Ill.

PASSENGER STEAMER CHEQUAMEGON. Built in 1903. Allowed 400 passengers. Triple-expansion engines. 175 lb. steam pressure. 125 ft. over all. 22 ft. beam. Electric lights. Search light. Steam steering gear. Draught, 8 ft. 10 in. Rated A1. Information and price apply to C. A. Webb, Traverse City, Michigan.

SMALL STEAMER AND LARGE lighter for sale. Steamer has carrying capacity of 275 tons; speed 10 to 12 miles per hour; length 117 ft. over all; beam 24 ft.; depth 8 ft.; engine, 18 x 20; boilers in first-class condition. Steamer entirely rebuilt and newly outfitted by American Ship Building Co. one year ago. Has hoisting engine and derrick forward with lifting capacity 7 to 10 tons. Will make good sand sucker or could be used for contracting, dredging, etc. Lighter has carrying capacity of about 600 tons; length 127 ft.; beam 30 ft.; depth 7 ft. Is in first-class condition and fully equipped for wrecking and dredging operations. The equipment includes 1 derrick and deck engine with lifting capacity of 25 tons, 1 large clam shell, 1 100 H. P. boiler, 4 large anchors with cables and buoys, 1 complete diving outfit, 1 swinging engine, 1 dynamo engine and dynamo, etc. Must be sold to close the estate of Walter V. Metcalf, deceased. For full particulars address Toland & Pearson, Attorneys, 541 Society for Savings Bldg., Cleveland, O.

TUG FOR SALE. TUG "J. J. Evans" for sale, in first-class condition, rebuilt November, 1907, hull of oak, 45 ft. keel length, 12 ft. beam, 6 ft. depth, 14 gross tons, high pressure Sutton engine, cylinder 14 x 14 in., firebox boiler, 5 x 9½ ft., 100 lbs. steam. Can be seen at Two Rivers, Wis. Address Bank of Two Rivers, Two Rivers, Wis.

TUGS FOR SALE. STEEL TUG, now building. 105 ft. long overall, 21 ft. beam, 12 ft. 3 in. depth of hold. Engine 15 x 30 x 22, Scotch boiler, 150 lbs. steam. Coal capacity 80 tons. Also a tug 67 ft. long, of oak. 16½ ft. beam, 7½ ft. depth of hold. Single engine, 14 x 16. Boiler 6½ ft. x 12 ft. for 130 lbs. steam pressure. Fresh water tanks forward and aft. Independent pumps. Keel Condenser. Also two small tugs, not new. Address McIntyre & Henderson, foot of Montgomery St., Baltimore, Md.

ONE OR TWO McMYLER DERRICKS wanted. Address James Murphy, Fort William, Ont.

McMYLER DERRICK FOR SALE, 3 tons capacity, 14 ft. gage. Located at Cleveland. Address Box 50, MARINE REVIEW, Cleveland, O.

STEAM BARGE FOR SALE. "VAN Allen" 136 x 26 x 10 ft., good condition and well found, compound engine, boiler 1901. Make offer to Toronto Electric Light Co., Toronto, Ontario.

AN EXCELLENT CHANCE TO buy at a low figure an up-to-date slightly used triple-expansion marine engine with shaft. Surface condenser, air and circulating pumps, size 14-24-40 by 30 stroke. Also Scotch marine boiler built for it, 200 lbs. steam. Address B. F. Conway, 39 Cortlandt St., New York City.

U. S. Engineer Office, Detroit, Mich., Feb. 27th, 1909. Sealed proposals for the construction of the superstructure of a movable dam for St. Marys Falls Canal, Sault Ste. Marie, Mich., will be received at this office until 3 P. M., March 30, 1909, and then publicly opened. Information on application. C. McD. Townsend, Lieut. Col., Engrs.

Sealed Proposals will be received at the office of the Light-House Engineer, Buffalo, N. Y., until 11 o'clock, A. M., March 30, 1909, and then opened, for furnishing materials and labor of all kinds necessary for the construction of a light-house and an iron beacon at the entrance to Cleveland Harbor, Ohio.

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14-24-40 x 30 Triple Expansion Engine.
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